FOUNDRY TRADE JOURNAL

EST. 1902

WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

VOL. 104
No. 2162
Registered at the G.P.O. as a Newspaper

MARCH 20, 1958
Offices: John Adam House, John Adam St., London, W.C.2

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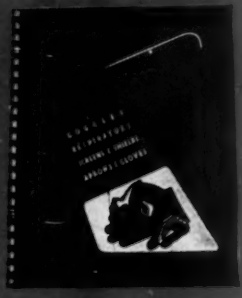

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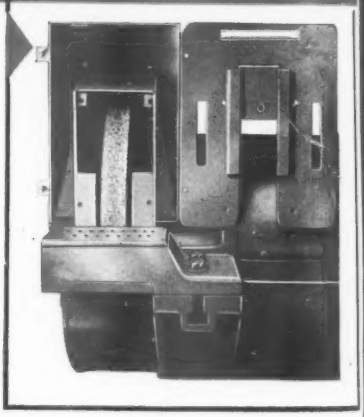

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Vol. 104 March 20, 1958 No. 2162

Established 1902

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IRON & STEEL TRADES JOURNAL

Single copy 1s.; *by post* 1s. 4d.

Annual subscription: home 52s., *abroad* 60s. *(prepaid)*

Editor:
V. C. FAULKNER, F.R.S.A., HON.M.I.B.F.

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Publisher: H. J. DWYER

Circulation Manager: E. T. GRIFFITHS

District Representatives:
G. P. ELLIOTT (Northern Area)
T. H. SMITH (Scotland)

The FOUNDRY TRADE JOURNAL is the official organ of the British Steel Founders' Association; Association of Bronze & Brass Founders; Light Metal Founders Association; Foundry Trades' Equipment & Supplies Association; and the National Society of Master Patternmakers.

AN INDUSTRIAL NEWSPAPERS PUBLICATION

Published Every Thursday by Industrial Newspapers, Limited

BARRINGTON HOOPER, C.B.E.
Chairman and Joint Managing Director

F. BARRINGTON HOOPER, B.A.
Joint Managing Director and Commercial Director

F. R. LEWIS, *Director*

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17-19, JOHN ADAM STREET,
ADELPHI, LONDON, W.C.2

Telephone: Trafalgar 6171 *(Private Branch Exchange)*
Telegraph Address: "Zacatecas Rand, London."

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Lunettes de Protection en Fonderie—Premier Rapport d'une Commission Commune de Consultation.
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Schutzbrillen in der Giesserei. Erster Bericht des vereinigten beratenden Ausschusses.
Der Bericht des beratenden Ausschusses für Schutzbrillen in der Giesserei, dessen erster Teil in einer früheren Nummer dieser Zeitschrift abgedruckt war, wird hier fortgesetzt und beendet. Dem Berichte des Unterausschusses über bis jetzt durchgefuhrte Versuche, welche in Beilage I des Hauptberichtes angefuhrt sind, folgt ein weiterer Beitrag als Beilage II, in welchem die Ergebnisse der ballistischen Laboratoriumsversuche beschrieben und durch Tabellen belegt werden, die dazu dienen, die relative Widerstandsfähigkeit der verschiedenen Schutzbrillengläsertypen festzustellen. 327

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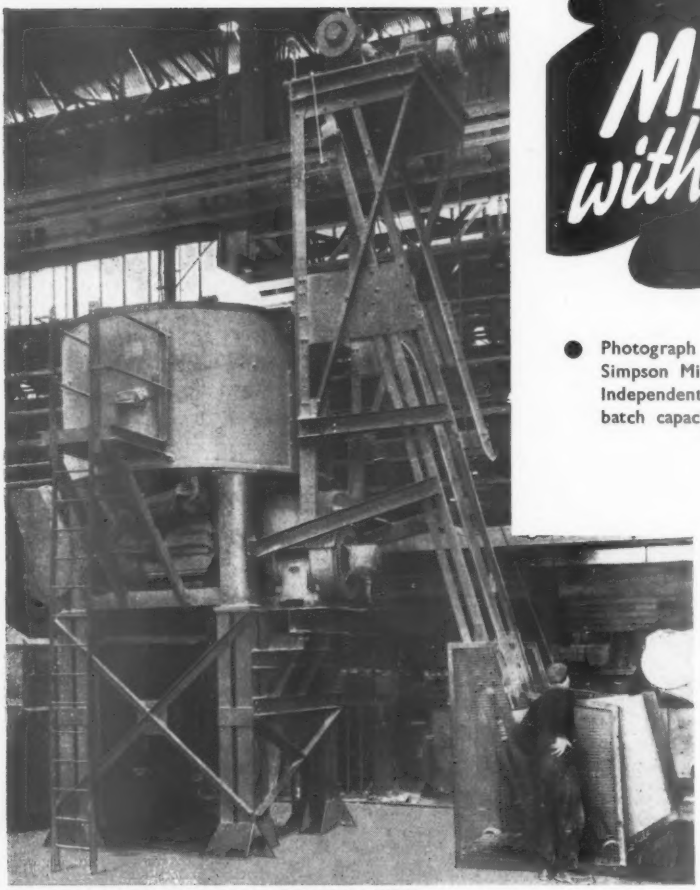
MIXING with the Best



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FOUNDRY
TRADE JOURNAL

Vol. 104 MARCH 20, 1958 No. 2162

Delivering the Goods

All the great research organizations of the world are searching for the best methods of placing the technical knowledge they possess into works practice—the only place where it really matters. All, of course, use the printed word, but there are differences thereafter. The British Cast Iron Research Association periodically organizes practical courses in sand testing, arranges symposia on specialized subjects and has available a team of technologists which, at the request of a foundry, reports confidentially on its methods and general efficiency. France, through the *Centre Technique des Industries de la Fonderie*, has available about a dozen regional laboratories, which, in addition to giving a day-to-day local service, does, through a regional cost bureau, keep track of the money spent in carrying out the various operations. They are thus in a position to tell any foundry that sand preparation, the melting of metal, or any other section would appear to be well or badly conducted. In the latter case, local suggestions are made, but if too complicated, are referred to headquarters. This applies to all cast metals.

In Germany, the *Institut für Giessereitechnik* in Düsseldorf is primarily a co-operative consulting organization, which is subsidized by the employers' federation. It is confined to iron, steel, and malleable castings. All tests are carried out for the foundries and invoiced at prices fixed by the industry. The laboratories, which we recently inspected, are well, but not extravagantly equipped, and are obviously growing. A certain amount of research is undertaken and close contact is maintained with the technical colleges and research associations. To give the service to the actual foundries, a " laboratory on wheels " has been designed and built. It is quite self-contained, except for high-temperature work, when an electrical connection is made to the works visited. It is manned by a staff of four, including the driver who also acts as a laboratory assistant, and general handyman. It costs about £50 a day to function, but is available to industry at half that figure. In the USA, there is no nationally-sponsored research association, but the universities and institutes, such as Battelle and Melon, give much the same service. Recently, the American Foundrymen's Society have been organizing at their headquarters intensive technical courses, which have attracted nation-wide interest.

Which is the best system for getting high-grade technology on to the foundry floor is a moot question. The size of the country served is a cardinal factor, whilst the acquisition and training of the requisite staff is not too easy. Much tact has to be displayed if industrial " corns " are not to be trodden on. In Germany, for instance, such matters as plant equipment and layout are excluded from the advisory service rendered by *Giesserei Institut*. Probably the system developed by each country is the best in the prevailing circumstances, but we like the idea of the " service bus " because the figures from the tests taken and reported upon are more easily comparable, than when relying on those carried out by the works themselves. The cores for certain tests, for example, are all made at headquarters.

ABBF Area Meeting

Lancashire & Cheshire Areas

When members in the Lancashire and Cheshire areas of the Association of Bronze and Brass Founders met in Manchester on March 4, the ABBF national president, Mr. P. B. Higgins, was able to give very full information on the activities in which he has been engaged, particularly those which he has promoted with the object of getting the foundry and non-ferrous associations to work together to protect and further the interests of their industries—much recent and projected legislation, foundry regulations and developments arising from the proposed European Free Trade Area made such liaison most desirable.

The president said that it was the view of the Government that a European Free Trade Area would come into being; it was, therefore, important that foundries should be in a position to co-operate with their customers to enable them to compete with other European manufacturers, and they must know what was happening in the foundries in other countries. In order to be informed in this way, he said, the Association had applied for a seat on the European Committee of Foundry Associations and fully expected to be admitted to membership. Details were given next of the activities of this European Committee, one of which was the organization of the European Foundry Apprentice Competition, first held in 1957 and to be held annually in future. The selection of candidates, in which the foundry associations and the Institute of British Foundrymen were co-operating, was a work of some magnitude and the help of those qualified to assist the selection committee would be welcome.

Technical Work

Details of the work being done by the technical committee of the Association were explained. Mr. Mantle, chief liaison officer of the British Non-Ferrous Metals Research Association, referred to the formation of the ABBF Technical Advisory and Research Group Liaison Committee to provide liaison between the ABBF and the BNFMRA; the committee had held two meetings with excellent results.

Some interesting information was given by Mr. Mantle about work done and at present in hand for the non-ferrous metals industry, which was likely to be of great practical value. Later, Mr. Mantle spoke about the publication: "Survey of Furnaces for Melting Copper Alloys, with Cost Data compiled under Production Conditions in Sand Foundries." He explained the method of compilation and the tables of running costs. Dealing with questions, he urged that members to get value from the book should compile their own costs on a similar basis and compare them with those published. In conclusion, he expressed his appreciation of the keeping of records by a number of foundries which had enabled the survey to be compiled.

Latest Foundry Statistics

Steel Castings. The Iron and Steel Board in their *Bulletin* for February announce that the average weekly output of steel castings during January was 6,400 tons or 1,300 tons higher than December. The former figure was the general average for 1957. Employment in the steel foundry on January 4 was returned at 20,660, that is 240 fewer than a month earlier but 190 more than a year ago.

George Kent Publicity Programme

Publicity plans currently in hand by George Kent, Limited, of Luton, Bedfordshire, include participation in the Instruments, Electronics and Automation Exhibition at Olympia, April 16-25, a continental tour covering Belgium and Germany, and finally a display of mechanical water meters at the Association of Waterworks Officers' conference and exhibition in Llandudno.

In Germany the company will take part in the ACHEMA Exhibition at Frankfurt in May. One of the principal items of interest in its mobile exhibition will be the recently-introduced "Commander KE" high-speed electronic self-balancing temperature recorder. The principal theme of the Kent stand at Olympia will be the Commander range of instrumentation, with a representative selection of its many variations, the main section of which is devoted to flow measurement and control. Three "Commander KE's" will be on show, the first of which will be working as a temperature recorder-controller with a radiation pyrometer and a Mark 30 pneumatic-controlling unit, the second as an oxygen controller, and the third as a straight temperature recorder.

At Llandudno the company are again exhibiting a wide variety of their mechanical water meters for flow rates ranging from 1 gal. per hr. to 5,000 gal. per hr. These include the M2 rotary-piston meters, which have the ability to register, with accuracy, very low rates of flow and are eminently suited for the measurement of domestic-water supplies. For industrial applications, sectioned models of the larger "Master" rotary-piston meter and the vertical-helix "Torrent" meter are being displayed. A sectioned model of the new "Compound" meter for the measurement of cold-water flows is also to be shown.

Modern Baths on Show

A new showroom has been opened at 28, Brook Street, London, W.1, by Allied Ironfounders, Limited, manufacturers of cooking and heating apparatus, builders' castings and baths. The showroom has been designed to display modern baths in attractive settings and by intelligent use of the space available some 14 appliances have been accommodated.

The baths have been displayed so as to suggest their potential appearance value when installed in conjunction with other modern bathroom furnishings and fittings. The company's newest luxury baths are on show and this permanent exhibition should stimulate considerable interest among those conscious of modern décor and convenience.

Baths are also playing their part in the *Daily Mail* Ideal Home Exhibition at Olympia (March 3-29), where four of the horses in The Village feature baths manufactured by Biston Foundries, Limited. Among these is the "Atlanta" model in which a break is made with the conventional curved bath by a shallow, flat-bottomed design. The exhibits can be seen in the Davis House, the Berg 1958 Exhibition House and the Berg Bungalow and, finally, at the Sussex Cottage.

BORAX (HOLDINGS), LIMITED—Mr. Abel Smith has resigned as chairman after 20 years in that position, but he remains on the board. Lord Clitheroe, who has been a director for 11 years and deputy chairman for the last three years, has now been elected chairman, and Mr. Frederick A. Lesser has succeeded Lord Clitheroe as deputy chairman while continuing to occupy the position of managing director.

Influence of Blast Input, Coke Size and Melting Coke Ratios on Cupola Performance

By F. Danis and M. Decrop

Gradually, as a result of several researches of recent years into the detail of cupola operation, a much greater understanding of this type of foundry melting equipment is being built up. The new research, reported in what follows, is a further step in this direction in that it analyses—with the meticulous detail, logical exposition and high accuracy usual amongst Continental research workers—the relative effects of a whole set of variables. It may seem to the casual reader that what was a simple piece of melting equipment is fast becoming a complicated apparatus. However, in the reality, the reverse holds, namely that what were always complicated melting phenomena (so inexplicable that to a cupola the feminine gender is always applied) are becoming so much better understood that control of the furnace is in reality being simplified.

The research reported had for its objective an examination of the influence of three important factors on cupola performance—blast input, coke size, and quantity of melting coke. (The influence of coke quality on melting results is to be the subject of a further series of tests.) The tests detailed in what follows were carried out using coke (normally termed " Foundry Coke ") in the following size ranges: 1¼ to 2½; 2½ to 3½; 3½ to 4¾, and 1½ to 6 in., with melting coke ratios varying between 6.7 and 15 per cent. and blast inputs ranging from unity to double that amount with diverse intermediate values. This first series of tests involved the carrying out of 19 experimental melts.

Experimental Layout

The cupola on which the tests were made had a starting diameter of 28 in. with a lining thickness of 10-in. It was furnished with four double self-slagging tuyeres provided with a system of air-tight changeover valves. Fig. 1 is a schematic diagram showing the main outlines of the melting plant and the position of the various check-points—specially installed for this work—which permitted observations and measurements to be taken in the interior of the cupola and the taking of gas samples at various levels.

DATA ASSEMBLED

All factors entering into the thermal balance sheet of melting were logged as well as the weighing of everything that went into and left the cupola.

Charging and Charge Weight

The metallic charges and the coke were weighed on a beam machine. The charging of the cupola was carried out by means of a drop-bottom bucket and casting ladles were weighed on a crane-suspended steel yard type of scale. The bed coke was carefully gauged for each melt and set for all the tests at about 5-ft. above the upper level of the tuyeres.

Blast-input Measurement

The cupola was blown by a direct-coupled centrifugal fan, the measurement of the blast input being calculated by three different methods. In the first instance, the blowing system was fitted with an automatic input regulator comprising a device made up of an electric resistance, which more or less cooled by the blast. This system was not very precise and for that reason a venturi was later installed (Fig. 1) under suction from the fan and connected with a water differential manometer. A third system was made up of a pitôt Ritter tube connected to an automatic registering manometer of the Meci type (one revolution every six hours), the pitôt Ritter tube being placed at the point of average speed in the neck of the venturi (about 6.2-in. dia.).

The venturi and the pitôt Ritter tube gave very comparable results, whilst the regulator gave fairly wide variations in relation to the other two systems when the input was low. Thus for these tests, most confidence was placed on the venturi sytem but where necesary, referrence was made to the results given by the pitôt tube. The blast input given by the venturi system is equal to $0.065\sqrt{H}$, being the difference in pressure measured between the entrance and the neck of the venturi (input in cub. metres per second, H in mm. of water).

To find out if air leaks existed between the fan and the cupola, the Authors blocked off the whole of the tuyeres with fireclay and started up the fan. They found neither pressure nor air-velocity readings on the differential gauge for the neck of the venturi, which permitted the deduction that leaks were negligible. A final check was carried out to verify the exactness of the amount of the blast employed by applying the results of gas analyses. Actually, using on the one hand the analyses of the coke used and on the other, the composition of the gases in the throat, the Authors were able to calculate the quantity of blast used per kilo of coke. It should be pointed out that most of the results obtained by the venturi method or by gas-analyses were concordant, except in the case of three or four melts.

To be able to calculate the input of air by weight, it was essential to take into account its temperature,

* Translated by courtesy of the *Association Technique de Fonderie* from a preprint of a Paper presented to their Thirtieth Congress (held in Paris, last year). The Authors are on the staff of the *Centre Technique des Industries de la Fonderie.*

Influences in Cupola Performance

as measured by a mercury thermometer and the moisture content with a wet- and dry-bulb hygrometer and a psychrometer.

Temperature Measurement

To measure the temperature of the iron, a disappearing-filament optical pyrometer, furnished with a correction scale which took into account the emissivity of the iron (Oplix instrument) was used. The sighting was made at about a metre distance behind the stream of iron at the end of the spout. Checks were also made using a Bi-Optix disappearing filament instrument with colour correction; the temperatures given by this apparatus were about 30 deg. C. lower than those given by the Optix apparatus, which would seem to indicate that the correction applied to the Optix was excessive. However, the temperature readings obtained were within about 10 deg. of the corrected scale.

Several measurements were taken on each tap and the figures given in this report correspond to the weighted average for the stable period of melting. It should be pointed out that at the beginning of each melt and because of the pre-heating of the hearth, the temperature of the iron was normally higher than during the stable period. After that the temperature would subsequently stabilize itself or would become progressively lower as the bed coke became burnt away, consequent upon too great a blast input relative to the percentage of coke employed.

Measurement of temperatures inside the cupola were carried out by first stopping the blast immediately after de-slagging. Blast-temperature measurements were made in the tuyeres either at the centre or at the top, each test being made twice, once before poking and once afterwards. It is noteworthy that after poking, the temperatures measured would often be higher when taken below the normal zone of maximum temperature or might be lower when taken above this zone. The Authors considered the inside of a cupola to be a completely closed container, and thus, to represent a "black body." This view was confirmed by the use of the Bi-Optix pyrometer when the differences were only of the same order as experimental error.

It should be pointed out that it was essential to take temperature measurements immediately after the stopping of the blast. If the stoppage be only for a few minutes' duration, especially at the tuyeres, a distinct lowering of the temperature inside the cupola results. The temperature of the throat gases was plotted by a thermocouple coupled to a recorder. It was possible to verify that this temperature depended only to a small extent on the depth of insertion of the probe into the cupola. Moreover, the intermittent checks using a portable pyrometer with either a chromel-alumel or iron-constant couple well confirmed the observations recorded. It has been noted that in the case of a charge hanging or at the end of a melt, the gas temperature rose rapidly and on occasions went beyond the top limit of the couple, which then had to be replaced. Temperature measurements were also made on the outside walls of the cupola using a contact pyrometer connected to a portable galvanometer.

Moisture Content of the Coke

The moisture content of the coke was measured by the loss in weight on heating up about 55 lb. of the material. The moisture varied between 1 and 9 per cent.—figures which were also revealed in the gas-analyses results where there was a systematic variation and correlation according to the hydrogen content. The weight of delivery of coke was measured in the bin of which the dimensions were rigorously fixed, contained about 0.2 cub. metres (about 7 cub. ft.). The tared bin was weighed when filled with coke up to the brim. The characteristics of the coke employed in the tests is shown in Table I.

TABLE I.—*Properties of the Coke Used in the Tests.*

	Composition.		
Size (in.)	3½ to 4½	3½ to 4½	2½ to 3½
Ash* (per cent.)	9.38	10.0	9.9
Volatile matter (per cent.)	0.57	1.3	1.0
Sulphur (per cent.) ..	0.77	—	—

Range of Coke Sizes Chosen:
1½ to 2½-in. (uniform).
2½ to 3½-in. (uniform).
3½ to 4½-in. (uniform).
1½ to 6-in., made up of: 1½ to 2½-in.—1.5 per cent.
2½ to 3-in.—4.0 per cent.
3½ to 4½-in.—32.0 per cent.
4½ to 6-in.—62.5 per cent.
Above 6-in.—nil.

Physical Properties:

True Density (B)	1.946
Apparent Density (A)	0.997
Compactness, $\frac{A}{B}$	0.512
Bulk density	1½ to 2½-in.—0.51 1½ to 3½-in.—0.55 3½ to 4½-in.—0.49 ½ to 6-in.—0.52
Calorific Value ..	1½ to 2½—7,183 calories per gm. 2½ to 3½—7,035 „ „ „ 3½ to 4½—7,202 „ „ „

* Ash composition: SiO_2, 39.0; Al_2O_3, 36.0; Na_2O, 0.7; Fe_2O_3, 14.5; CaO, 3.9 and K_2O, 2.80 per cent.

Gas Analysis

During melting, samples of gas for analysis were taken from the cupola using a suction bulb and extractor to fill rubber containers. Most of these samples were taken at charging-door level, but to complete the study, some others were taken at various levels. The gas samples were simultaneously analysed by two portable sets of Orsatt's apparatus. The first of these, furnished with a potash absorption vessel and a platinum spiral, permitted the successive measurement first of the proportion of CO_2, then the contraction obtained by the burning of the combustible element ignited by a red-hot platinum spiral—the combustion being obtained by an air addition—gave finally the proportion of CO—transformed into CO_2—by second potash absorption. Comparison of the contraction and the CO content permitted an evaluation of the hydrogen content. The second apparatus was solely chemical in operation and allowed succes-

sively of the CO_2, O_2 and CO contents to be reported. These batch-type methods of testing only yielded a limited number of results during each melt—on average about five duplicate tests.

Period of Stability

It was found desirable to designate as the "stable period" of cupola operation the time when the iron from the cupola was obtained at a reasonably constant temperature and where, in addition, it was possible to regard the bed coke as remaining at the same level. It sometimes happened, for example, because of length of a melt, that it was only possible to observe a progressive lowering of this level; on the contrary, at other times, a very slow lifting of the level of the bed was observed and this has been taken care of in the thermal balance sheet.

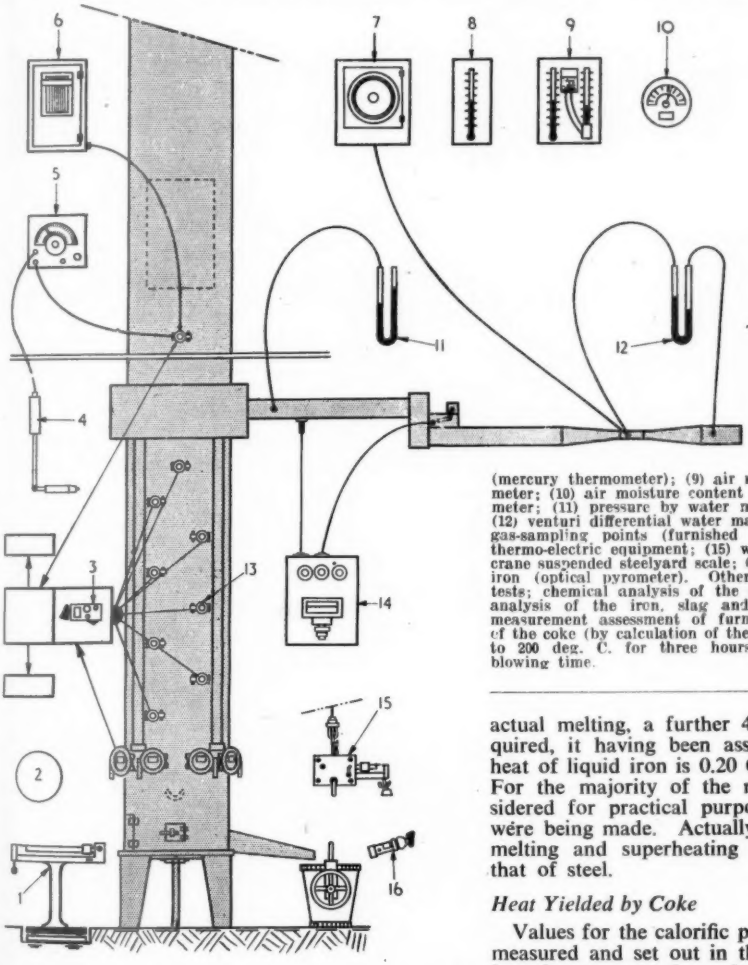

FIG. 1.—*Schematic layout diagram of the test cupola and various records taken.*

Key: (1) Weighing position of the materials charged, the "drop" and the slag; (2) automatic charging by drop-bottom bucket. ICAM type instrument for registering the time of charging; (3) positions of temperature measurement through peepholes; (4) cupola-wall temperature measurement by contact pyrometer; (5) and (6) gas temperature measurement and recording (iron-Constantan couple); (7) blast differential, pressure recording by pitôt-Ritter tube (dial manometer); (8) blast temperature (mercury thermometer); (9) air moisture content by psychrometer; (10) air moisture content by wet and dry-bulb hygrometer; (11) pressure by water manometer in the wind box; (12) venturi differential water manometer; (13) peepholes and gas-sampling points (furnished with cocks); (14) regulator thermo-electric equipment; (15) weighing the liquid metal by crane suspended steelyard scale; (16) temperature of the liquid iron (optical pyrometer). Other operations included: chill tests; chemical analysis of the materials charged; chemical analysis of the iron, slag and other materials produced; measurement assessment of furnace losses, moisture content of the coke (by calculation of the loss in weight after heating to 200 deg. C. for three hours) and measurement of the blowing time.

Thermal Balance

The three elements of the balance sheet have been calculated on the basis of what is set out as follows:—

Heat for Melting and Superheating the Metal (Useful Heat)

The Authors have previously reported* that to raise 1 kg. of iron to 1,150 deg. C. (its melting point) requires 190 "large" calories (Cals); for actual melting, a further 47 Cals per kg. are required, it having been assumed that the specific heat of liquid iron is 0.20 Cals per kg. per degree. For the majority of the melts, it has been considered for practical purposes that eutectic irons were being made. Actually, for these, the heat of melting and superheating differs but little from that of steel.

Heat Yielded by Coke

Values for the calorific power of coke have been measured and set out in this report. The figures have been corrected—as they referred to the calorific power of the dry fuel—so as to take into account the moisture in coke used for each test and heat of vaporization of this moisture was allowed for. Finally, for each test, there was calculated the actual rate of coke burning, taking into account

* *Fonderie*, No. 119, p. 4822, *et seq.*, "Notes on the Cold-blast Cupola."

Influences in Cupola Performance

the weight of water contained in the coke charges, the quantity of fixed carbon taken up in the recarburization of the metal and variations in the level of the coke bed.

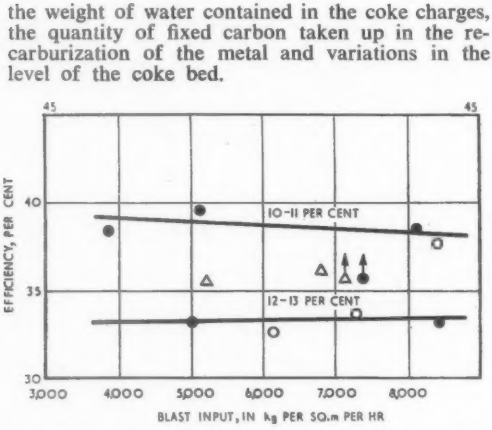

FIG. 2.—*Thermal efficiency of the cupola related to blast input for two coke percentages.* (a) 10 *to* 11 *and* (b) 12 *to* 13 *per cent.*

Key: Coke size, 0—2½ to 3-in., ●—3½ to 4¼-in., and Δ 1½ to 6-in. The small arrows indicate the probable direction in which particular points would be displaced if the quantity of coke used in the corresponding test had been brought into line with the neighbouring curve.

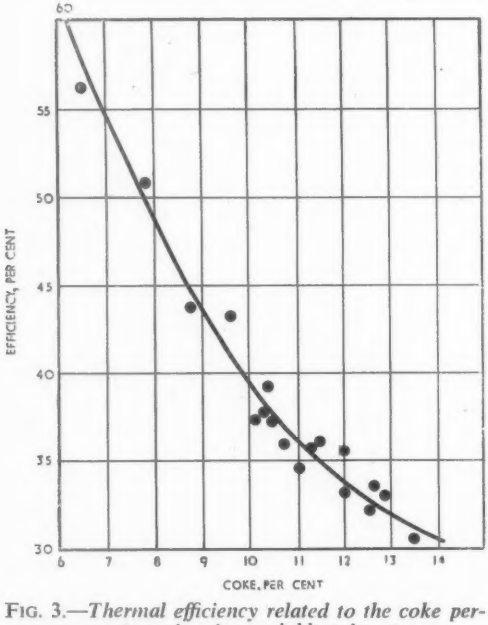

FIG. 3.—*Thermal efficiency related to the coke percentage, its size and blast input.*

Heat Yielded by Elements of the Metallic Charge

By taking into consideration the composition of the iron charged and that of the liquid metal tapped, it was possible to make an approximation of the final pick-up of carbon, and also the metallic losses of iron, silicon and manganese. Moreover, such a satisfactory recovery resulted that it was possible to calculate the metallic losses of iron and manganese from the analysis of the slags.

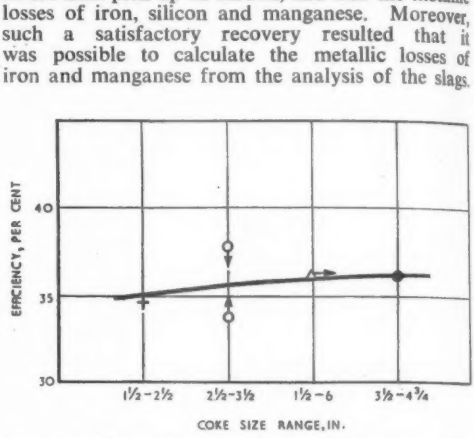

FIG. 4.—*Thermal efficiency as related to coke size, when using about* 11 *per cent. of coke* (*the points for the* 2½- *to* 3½*-in. size actually correspond to* 10 *and* 12 *per cent. of coke*).

From this information, it was possible to evaluate the recarburization factor and give data for calculating the weight of coke taken up as carbon by the iron. For calorific values, the Authors have taken the following figures:—for iron, 1,600, for silicon, 7,300, and for manganese, 1,650 Cals per kilo.

Loss of Sensible and Latent Heat of the Gases

From the results of the gas analyses, the Authors took average values for the test periods for CO_2, CO, O_2 and H_2 contents. In addition, they took average temperatures as shown by an automatic registering pyrometer. These data permitted the calculation of the sensible heat and latent heat taken up by the gases by relating the figures obtained to a kilo of coke. For the sake of simplification, the volumes of the various gaseous elements have been taken in molecules. Account has been taken of the moisture brought in by the blast after having calculated its volume per kilo of coke and in addition, the release of CO_2 arising from the decomposition of the limestone has been taken into consideration, the value being taken as three molecules of CO_2 per kilo of coke.

Slag Losses

The Authors have divided slag losses into two parts; the latent heat of the formation of the slag which includes on the one hand, the quantity of calories necessary for the decomposition of the limestone, *i.e.*, 425 Cals per kg., and on the other, the heat of formation of the slag silicates and the sensible loss heat calculated on the basis of a specific heat of 0.2 Cal per kg.

Radiation Losses

Temperatures taken at different points on the outside walls of the cupola, using a contact pyro-

meter, did not notably vary under the particular conditions worked. Finally, after making all the calculations, the Authors found that radiation losses from their cupola gave an average figure of 15,000 Cals. per hour.

Thermal Efficiency

Thermal efficiency was calculated from the ratio of the useful heat to the total heat supplied, which included the calories brought in by the combustion of the various elements of the charge other than the coke.

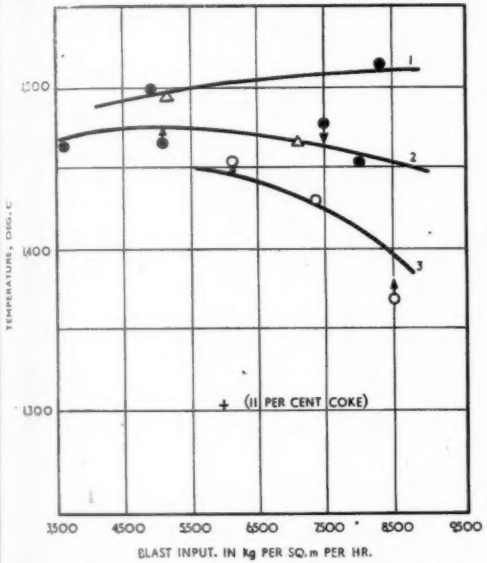

FIG. 5.—*Temperature of the iron related to the blast input for various coke percentages and sizes.*

Key: Coke size, +—1½ to 2½-in., o—2½ to 3½-in., ●—3½ to 4½-in., and Δ—1½ to 6-in.

TEST RESULTS

In order to appreciate the results, the Authors have established, in addition to the thermal efficiency, a certain number of criteria, confirming the results found by practical founders.

(1) For the temperature of the iron as tapped, it was estimated that for the usual types of castings, engineering components and thin-sectioned items, the spout temperature should not be less than 1,450 deg. C. This minimum can be reduced when making very large castings, such as ingot moulds, to about 1,350 to 1,400 deg. C.

(2) The hourly production of the cupola in tons per hour is related to the cross-section of the melting zone in sq. ft.

(3) As to the possible oxidation of the iron, a fault to be avoided at all costs, this can, in general, happen below the temperatures indicated, yet certain "hot" irons can nevertheless be found to be oxidized.

(4) In a general way, an important criterion to take into consideration is the influence of coke on the chemical composition of the iron, that is recarburization and metallic losses. It has been possible to take into account the Si and Mn losses in the thermal balance sheet, but the complete impact of the question needs examination in detail from the metallurgical point of view, as well also the influence of coke on refractory wear, and this will be done in a subsequent report.

(5) Thus, note has been taken of the essentials of regular cupola operation, such as melting practice and the rate of consumption of the bed coke by

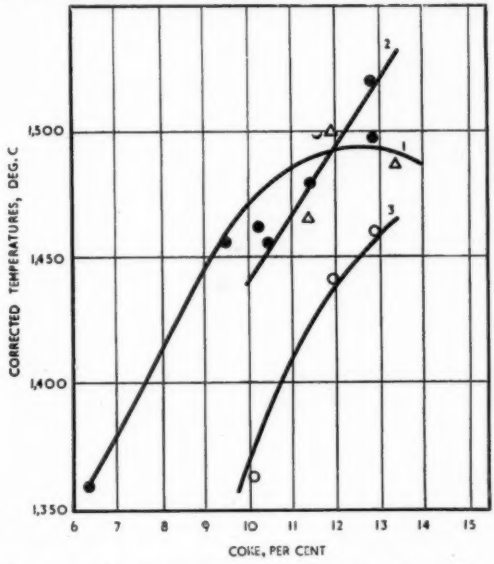

FIG. 6.—*Temperature of the iron related to coke percentages for two blast inputs and three coke sizes.*

Key: Coke size, o—2½ to 3½-in., ●—3½ to 4½-in., and Δ—1½ to 6-in. Curve (1) 5,300, and curves (2) and (3) 8,000 kg. per sq. m. blast input per hr.*

following its level through the peep-holes installed in the cupola.

Tests carried out, being in the nature of industrial trials, have not been conducted with a precision comparable with laboratory experiments, although the experimental precautions taken did (generally speaking) allow of the furnishing of a thermal balance sheet which was a satisfactory approximation. Nevertheless, some of the tests showed some wide dispersion of results. This is partly because it is difficult to have complete mastery over such a plant as a cupola, the working of which follows a complicated mechanism. That is why the values of the blast or the amount of coke established *a priori* for the carrying out of the tests were not those which, in actual fact, were finally

* One kg. per sq. metre = approximately 0.2048 lbs. per sq. ft.

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used and which appear in the results of the tests. Comparison of results has thus necessitated a certain amount of extrapolation. This has been done by introducing some results culled from past experience, otherwise, a great expansion in the number of tests to be made would have been involved.

However, it should be pointed out that the means at the Authors' disposal, both as to staff and materials, envisaged melts of average length (about four hours) and the tests were, in fact, encompassed within these limits. In such a period, it was found possible to establish regular running conditions, characterized by a constant metal temperature and a relatively fixed level of the bed coke. However, the period of stable operation was often on the short side (about an hour) and the precision of the measurement was obviously affected by that limitation.

For presenting all the results, it is proposed to follow the same plan of reporting, successively including the examination, in order of importance, of each factor: (*a*) As a function of the blast input and the coke size for various dimensions; (*b*) as a function of the weight of coke to the blast input and constant size for various dimensions, and (*c*) as a function of coke size to the amount of coke and constant blast input.

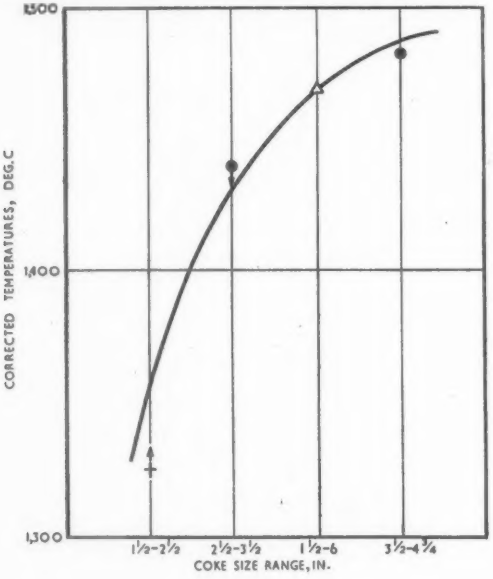

FIG. 7.—*Temperature of the iron related to coke size, when using about* 11 *per cent. of coke and a blast input of* 7,000 *kg. of air per hour per sq. metre of cupola cross-section.*

Key: Coke sizes, +—1½ to 2½-in., ●—3½ to 4¾-in., and Δ—1½ to 6-in.

Thermal Efficiency of the Cupola

(*a*) *As a Function of the Blast Input:* For this the graph (Fig. 2) seems to indicate that the blast input has practically no influence on the thermal efficiency of the cupola. However, it should be noted that a small decrease in thermal efficiency takes place when the blast input increases as shown in the curve for 10 to 11 per cent. of coke—a decrease which is not reflected in the curve for 12 to 13 per cent. of coke. It would appear likely that the amount of coke between the charges has a significant influence on the thermal efficiency.

(*b*) *As a Function of the Weight of Coke:* Fig. 3 well illustrates this phenomenon and shows that the thermal efficiency decreases rapidly when the percentage of coke increases. This result would seem to be perfectly logical. It should further be noted that the phenomenon is independent of coke size. Actually, as will be shown later, the production of iron increases as the coke size diminishes, since correlatively, its temperature decreases which in summation does not influence the efficiency.

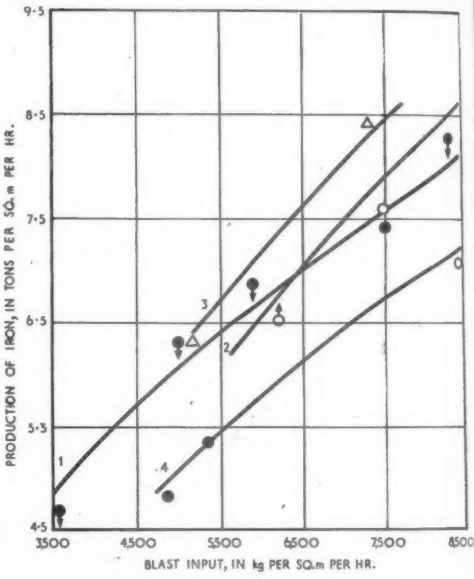

FIG. 8.—*Production of iron related to blast input, a virtually constant amount of coke of different sizes.*

Key: Curve (1) coke size 3½ to 4¾-in., 10 to 11 per cent.; curve (2) 2½ to 3½-in. coke and 10 to 12 per cent.; curve (3) 1½ to 6-in. coke and 10 to 12 per cent.; curve (4) 3½ to 4¾-in. coke and 12 to 13 per cent.

(*c*) *As a Function of Coke Size:* This effect is confirmed by Fig. 4 where the thermal efficiency curve as a function of coke size is a straight line. From this aspect, it should be noted that the 1½- to

6-in. coke gives results which are identical with those for the 3½- to 4¾-in. coke.

Temperature of the Iron

The average temperatures of the iron at the spout were taken for a period of one hour's melting. Curve (1) of Fig. 5, which plots 12 to 13 per cent. of coke sized to 3½ to 4¾ and 1½ to 6, would seem to indicate that the temperature of the iron increases with the blast input within the limits of the tests undertaken. On the other hand, curve (2), where from 10 to 11 per cent. of coke of the same sizes was used, the iron temperature went down after a certain blast input. The results have shown that at the start, the bed coke is partially burnt fairly rapidly, which in itself explains this phenomenon. It will be noted from curve (3), when 2½- to 3½-in. coke was used, that the drop in temperature is markedly increased, the burning away of the coke bed being much quicker.

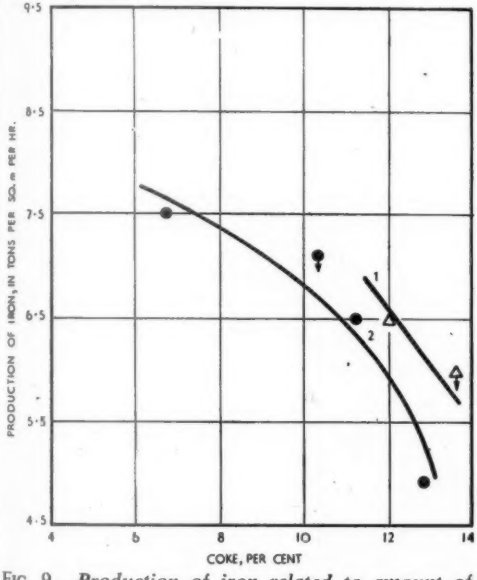

FIG. 9.—*Production of iron related to amount of coke with constant blast input for two coke sizes.*

Key: Curve (1) coke size 1½ to 6-in.; curve (2) 3½ to 4¾-in.

However, it would appear, so far, that the amount of coke has a real effect on the temperature of the iron; this effect showing up much more clearly in Fig. 6. It would appear according to this graph that if it be desired to obtain a temperature of the iron equal to that given by the 3½- to 4¾-in. and 2½- to 3½-in. coke size, it is necessary with the latter size substantially to increase the weight of the coke charge. The drop in temperature shown by curve (1) beyond 12 per cent. of coke is seemingly due to the fact that blast input is much too low for the higher percentage of coke, which is confirmed by curve (2). Fig. 7 shows very clearly that the temperature of the iron related to a coke percentage and a given blast input decreases directly with coke size. Fig. 7 likewise shows the 3½- to 4¾-in. and 1½- to 6-in. cokes give practically the same results.

Quantity of Iron Produced

It is obvious from Figs. 8 and 9 that the production of iron varies in the same way as the blast

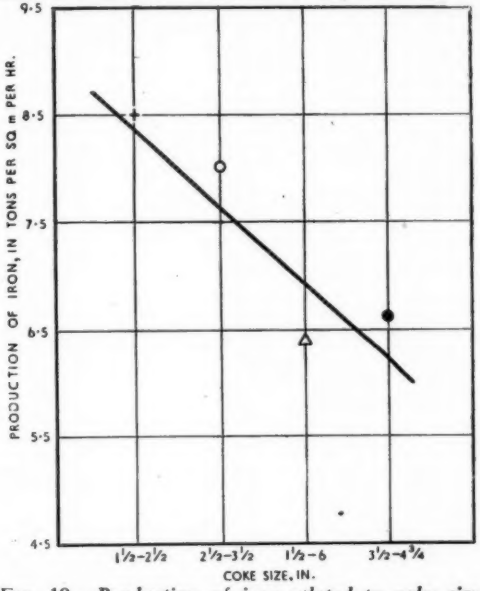

FIG. 10.—*Production of iron related to coke size for approximately the same coke charges and blast inputs.*

Key: Same as for Fig. 7.

input and that with a contant blast input, the production of iron varies inversely with the percentage of coke—a well-known fact. Actually, the burning away of the coke bed and its consequent drawbacks (rapid decrease in metal temperature) limits the possibility of increasing the blast. It has been found, for instance, that with about 12 to 14 per cent. of coke, the production should not exceed 5.5 D^2 in *tonnes* per hour (D is the effective diameter of the cupola expressed in metres, when using the 1½- to 2½-in. coke. With the 2½- to 3½-in. coke, the production should not exceed 6 D^2 and with the 1½- to 6-in. coke 7 D^2 and 7.5 D^2 with the 3½- to 4¾-in. coke.

In addition, Fig. 10 clearly shows that with the coke percentage and the blast input constant, the production of iron varies inversely with coke size. It appears that in this respect, the ½- to 6-in. coke lies between the 3½- to 4¾-in. and the 2½- to 3½-in. These statements can be explained by noting that the quantity of coke burnt in a unit of time, varies proportionately with the outside surface of the fuel, and increases as the size becomes less.

(To be continued)

Hadfields' Shareholders' Anxiety

Letters from shareholders, who were anxious because the quoted figure for the shares of Hadfields, Limited, was at a very depressed level, were referred to by the chairman of the company, Lord Dudley Gordon, at the annual meeting recently. The letters asked: "What are you going to do about it?" The point was, the chairman said, that the shares were much below their true level because they were artificially depressed by anxieties as to the future—including the threat of renationalization.

There was no evidence, he went on, that shareholders were losing their faith in Hadfields and, speaking of the larger shareholders such as insurance companies and corporations, he added: "I can say that there is no sign that those experts are tending to get rid of their Hadfields shares. I hope you will take that as a pointer."

Present difficulties in financing were delaying important additions to steel melting plant and other improvements, but, said Lord Dudley, they did not propose to stop expansion and stand still. They would continue to improve facilities for the future and particularly be ready to serve the country.

Replying to a suggestion by a Millspaugh shareholder that the increased profit of Millspaugh, Limited, was being used to bolster up Hadfields' diminished profit, Lord Dudley retorted that without Hadfields, it would be quite impossible for Millspaugh on its own to undertake the contracts it was carrying out successfully at the present time.

Results and Prospects of British Oxygen

"The width of our activity and the influence of new methods and new construction, particularly in the steel industry, encourage the view that we shall be able to give a good account at the next meeting, although the months ahead may prove to lack the buoyancy of recent years," says Mr. J. S. Hutchison, chairman of the British Oxygen Company, Limited, in his annual report. The company had confined its capital expenditure strictly to essentials to enable it to meet the continually growing demand for its products.

At September 30, 1957, there were projects for expenditure on capital account against which orders of £3,250,000 had been placed. This is expected to be financed from existing resources and from depreciation and profit retentions which are in excess of £4,000,000 per annum. During the past financial year sales expanded in all overseas countries, in some by as much as 25 per cent. Group trading profit increased from £5,198,464 to £5,964,085, and the net profit attributable to the parent company rose from £2,260,906 to £2,440,245. In view of the need to conserve resources, the directors have decided not to raise the dividend from the 1955-56 level of 10 per cent.

Core- and Mould-drying Stoves. Catalogue No. 40 issued by Stordy Engineering, Limited, Cumbria House, 85, Goldthorn Hill, Wolverhampton, describes and illustrates, by line drawings and pictures, a range of core- and mould-drying stoves using gas, electricity and solid fuels. In general, when references are made in the booklet to temperature the Centigrade scale is used, but in one case the Fahrenheit scale is employed. By resolution of the Foundry Trades Equipment & Supplies Association it was decided amongst members always to adopt the Centigrade scale for this class of plant. The stoves and ovens have a good and workmanlike appearance as has the leaflet.

Industrial Index Up

According to preliminary figures prepared by the Central Statistical Office, industrial production during January puts the index of industrial production for that month at 138-139 (1948=100). The index for December, 1957, was 135 (December, 1956, 133½), and for January of last year 138. January's figure, although an improvement on the preceding month and on January, 1957, is still down on the January figure of two years ago and production generally is declining, the improvement in the second and third quarters of last year not having been maintained.

Coal production during the month was some 5 per cent. below that of January last year and steel production was 2 per cent. lower, mainly due to a slabbing mill breakdown and the differing incidence of the Scottish New Year. Most other industrial activity continued at or slightly below the levels of the year before.

Order-books becoming run down has, however, affected certain other capital goods industries, such as machine tools and contractors' plant. The boom in the motor industry has gone a long way towards putting the January index at a fairly respectable level and the motor industry's exports rose by nearly 75 per cent. compared with the previous year. Exports of coal on the other hand were down by nearly 40 per cent. More steel, machinery, and electrical equipment, however, was exported.

Pig-iron and Steel Production

Steel production last month averaged 4,600 tons less than in February, 1957. This year's figure was 427,500 tons a week, compared with 407,100 tons in January, and 432,100 tons in February, 1957. Pig-iron production was at the rate of 272,700 tons a week, compared with 271,000 tons in January, and 267,600 tons a year ago.

Latest pig-iron and steel output figures (in tons), with the corresponding 1956 and 1957 returns, are shown in the following table:—

Period.	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
1957—December ..	275,500	14,329,000	397,900	20,692,000
1958—January ..	271,000	14,090,000	407,100	21,171,000
February ..	272,700	14,182,000	427,500	22,228,000
1956—December ..	262,300	13,637,000	395,900	20,587,000
1957—January ..	256,900	13,361,000	415,900	21,627,000
February ..	267,600	13,916,000	432,100	22,470,000

Engineers Discuss Standards

This year's conference of engineers responsible for standards will be held on May 21 at the Connaught Rooms in London. The conference will be opened by Mr. F. J. Erroll, Parliamentary Secretary to the Board of Trade, and Mr. H. Stafford, chairman of the standards committee of the Institution of Production Engineers, will preside. The conference is arranged jointly by the British Standards Institution and the Institution of Production Engineers. One of the main topics will be a discussion on the inch-metric problem from the standpoint of Britain's position as an exporter to both inch and metric countries.

Foundry Goggles . . . FIRST REPORT OF THE JOINT ADVISORY COMMITTEE

(Continued from page 269)

The report of the sub-committee of the Joint Advisory Committee on Foundry Goggles, part of which followed the JOURNAL'S *presentation of the main Report in a recent issue, continues with an account of high-velocity tests carried out to evaluate the strength of various lens materials against steel projectiles. The sub-committee's findings are summarized in a number of provisional conclusions, notable among which is the claim that laminated-plastics goggles provide the maximum degree of safety, and are superior in this respect to other types tested. A further contribution to the study is made in the report on laboratory ballistic trials of goggle lenses by Mr. A. M. Reid, B.Sc., which forms Appendix II of the original document and will be presented in full in a later issue of the* JOURNAL.

HIGH-VELOCITY BALLISTIC TESTS

When the sub-committee had satisfied themselves that the low-velocity ballistic testing was giving reliable results it turned its attention to higher-velocity tests because although it had been decided not to attempt to define "average velocity," there were known particular instances in which particles might be projected at high-velocity across a foundry. For instance, cut-off off wheels may work at peripheral speeds of 20,000 ft. per min., and when one of these wheels breaks, fragments are projected into space with an initial velocity equal to the wheel velocity, so that goggles might be struck at speeds in excess of 200 miles an hour. As has already been remarked, the maximum velocity attained by metal splashes originating from explosions is not known, nor has any attempt to determine them been made. On the other hand, high-velocity tests are obviously essential to the current work in view of the fact that certain flying particles are known to exceed 200 miles per hour.

Initially, the sub-committee were informed of a research project which had been carried out by the Ministry of Supply and were fortunate in having the opportunity of discussing this work with Major Reid who was responsible for it and who gave the information contained in Appendix II.

High-velocity ballistic tests were contemplated using velocities not less than 350 ft. per second; the first reason for this being that a material was being sought that would offer protection at this velocity in view of certain known risks and the second being the fact that if such a material were available, still higher test-velocities would be needed to test it to destruction. This view is held because it is contended that performances can never be guaranteed unless ultimate strengths and, in consequence, factors of safety are known. Major Reid tested at velocities up to 1,000 ft. per second and although an armament manufacturer might not call this a high velocity, it is high enough for the present purpose.

The high-velocity tests were done on toughened glass, laminated glass, "Perspex" and laminated-"Perspex," using a cold steel cube as the projectile. The following four very interesting results emerged:—(*a*) The tests showed that plastics were superior to glass against high-velocity cold projectiles. This agreed with the sub-committee's own results at low velocity, when using both cold and hot projectiles. (*b*) The tests showed that splinters

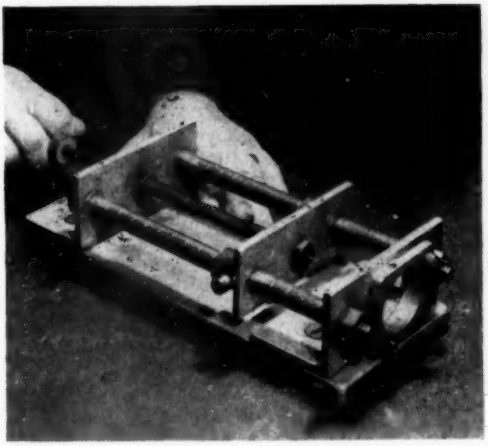

FIG. 5.—*Needle-impact type of goggle-testing machine.*

flew off the back lens of laminated glass specimens, even if these were not completely shattered. This confirmed the sub-committee's results at much lower velocities. (*c*) The tests indicated that plastics lenses could be made to withstand impact velocities up to 850 ft. per sec. This meant that the kind of protection being sought was in fact possible. (*d*) The tests indicated that only laminated-plastics lenses would give maximum protection, which appeared to depend on the soft interlayer.

Effect of Heat

Although the specimens were neither penetrated nor broken, the projectile embedded itself in the lens in those high-velocity tests where the impact was resisted. The tests were done cold, but it was wondered whether or not the laminated "Perspex" would take fire if the projectile had been red hot when it embedded itself in the lens. Owing to the

Foundry Goggles—First Report

urgency of the work no attempt was made to repeat the tests with hot projectiles but it was assumed that the effects of the impact and heat

TABLE 15.—*Effects of Heat on Specimens.*

A ½ in. dia. steel ball was heated to 900 deg. C. before being transferred from the furnace to the specimen. Two pieces of the material each of 50 mm. dia. were used to form the specimen. The one was laid on top of the other and the top one had a 11/32 in. dia. hole drilled through it beforehand to enable the ½ in. dia. ball to be located on the lower specimen.

Specimen.	Reaction.
0.050 in. acetate ..	Ball penetrated completely in 10.5 sec.
0.080 in. acetate ..	Ball penetrated completely in 12 sec.
0.060 in. " Cobex " ..	Ball in contact for 1 min.—did not penetrate and there was no fire.
0.060 in. " Bexoid " ..	Ball penetrated completely in 12 sec.

could be separated. Using the various plastics materials that had already been tested, a cavity was made in suitable specimens of each so that a ½-in. dia. steel ballbearing could be laid in it when the specimen was horizontal. Essentially the cavity was hemispherical and ¼-in. dia. at the surface of

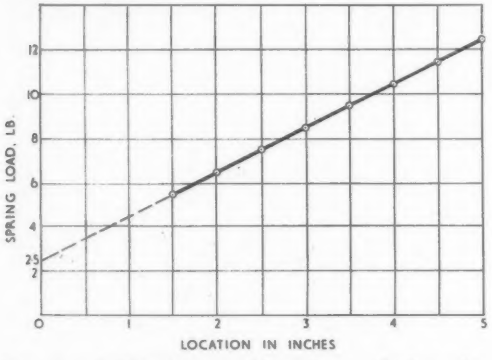

FIG. 6.—*Calibration graph used to calculate the average penetration force of the needle-type testing machine.*

the specimen, so that the ball was half in and half out when it had been inserted. The ballbearings were heated to 900 deg. C. before being placed in the cavity in a position similar to that which a cold

TABLE 16.—*Effects of Heat on Specimens.*

A ½ in. dia. steel ball was heated to 900 deg. C. before being transferred from the furnace to the specimen. A small hole was countersunk in each of the specimens to the depth of approximately ¼ of the sphere of the ½ in. diameter ball.

Specimen.	Reaction.
Allyl resin lens	The area of the lens around the ball took fire after 10 sec. but was extinguished by normal atmospheric draught in the laboratory. The ball burned through the lens in 19 sec.
Laminated-" Perspex " 0.276 in.	The ball failed to penetrate even though left in contact until cold.
Laminated-" Perspex " 0.305 in.	The ball failed to penetrate even though left in contact until cold.
" Perspex " lens ..	Ball penetrated completely in 26 sec.

missile would have reached if it had been projected in a high-velocity test.

The results are given in detail in Tables 15 and 16; it should be remembered that in practice the goggle lenses would probably be vertical when the hot missile was embedded in them, whilst in the empirical test just described they were horizontal with the hot metal lying on the top. The tests were, therefore, probably more severe than the ordinary circumstances of an accident. Nevertheless, none of the specimens burned fiercely enough to justify rejecting them out of hand, although some burned with a small flame, some charred and some melted. The hot ball penetrated some of the specimens and the time of penetration varied with the thickness of the material and with its chemical composition. Once again the laminated-" Perspex " lens gave the best results, the ball being allowed to cool to room temperature on the lens. During this time the lens did not take fire and the ball failed to penetrate it, being stopped, so far as could be seen, by the soft interlayer.

The sub-committee have not yet reached any final conclusions on this aspect of the matter but it is obvious that some lenses withstand hot metal fragments much better than others.

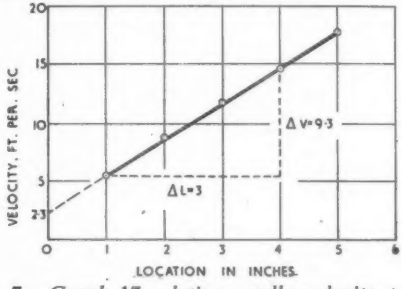

FIG. 7.—*Graph 17 relating needle velocity to the position of the specimen. $V=3.1\ L+2.3$, when V is the velocity in ft. per sec. and L the location in in.*

Needle Tests

Before concluding the first phase of its work the sub-committee thought that it ought to test the resistance of the specimens to impact when using a needle as the projectile. For this purpose the spring-operated machine shown in Fig. 5 was designed and constructed.

TABLE 17.—*Spring-compression Readings.*

Spring compression (in.)	Load.	
	Lb.	Oz.
1.5	5	8
2.0	6	8
2.5	7	8
3.0	8	8
3.5	9	8
4.0	10	8
4.5	11	8
5.0	12	8

Calibration

The machine was calibrated in order to be able to compare the energy levels of the moving needle with the other tests. The calibration was not scientifically accurate as certain assumptions were made in the calculations, but it was considered to be sufficiently close for practical purposes. The spring compression was determined against a range of loads and the results are given in Table 17. From this Table a graph (see Fig. 6) was drawn and then used to calculate the average force as follows:—

Where L=location in in.:—

$$\text{Average force} = \frac{\text{area under curve}}{\text{location}} = 2.5 + L.$$

But work done on moving parts=force×distance

$$i.e. = (2.5+L)\,L \text{ in. lb.} = \frac{2.5\,L+L^2}{12} \text{ ft. lb.}$$

As the spring weighs only 5 per cent. of the weight of the moving parts the energy used to accelerate the spring coils was disregarded and it was assumed that all the energy re-appeared as the kinetic energy of the moving parts. This kinetic energy is given by:—

$$KE = \frac{W\,V^2}{2g}$$ where KE = kinetic energy, W = weight in lb., V = velocity in ft. per sec., *i.e.* $V^2 = \frac{2g.\,KE}{W}$

TABLE 18.—*Needle Test Machine—Results Obtained Using 50 mm. Specimens Cut from Sheet "Bexoid."*

Spring compression (in.)	Needle velocity, ft. per sec.	Specimen thickness (in.)					
		0.005	0.010	0.020	0.030	0.040	0.060
1.5	6.95	Needle indentation. Bulged at back	Needle indentation. Bulged at back	Needle point indentation	Needle point indentation	Needle point indentation	Needle point indentation
2.0	8.78	Do.	Do.	Needle indentation. Bulged at back	Do.	Do.	Do.
2.5	10.05	Needle point just penetrated. Slight indication of cracking	Do.	Do.	Needle indentation. Bulged at back	Do.	Do.
3.0	11.89	Do.	Needle indentation. Bulged at back. Slight indication of crack	Do.	Do.	Needle indentation. Bulged at back	Do.
3.5	13.15	Do.	Needle point just penetrated. Slight indication of cracking	Needle indentation. Bulged at back. Slight indication of cracking	Do.	Do.	Do.
4.0	14.97	Do.	Do.	Do.	Do.	Do.	Do.
4.5	16.25	Do.	Do.	Do.	Needle indentation. Bulged at back. Slight indication of cracking	Do.	Do.
5.0	17.93	Do.	Do.	Needle point just penetrated	Do.	Do.	Do.

TABLE 19.—*Needle Test Machine Results Obtained Using 50 mm. Specimens Cut from Sheet "Cobex."*

Spring compression (in.)	Needle velocity, ft. per sec.	Specimen thickness (in.).					
		0.006	0.010	0.020	0.030	0.040	0.060
1.5	6.95	Needle indentation. Bulged at back	Needle indentation. Bulged at back	Needle point indentation	Needle point indentation	Needle point indentation	Needle point indentation
2.0	8.78	Do.	Do.	Needle indentation. Bulged at back	Do.	Do.	Do.
2.5	10.05	Needle point just penetrated	Do.	Do.	Needleindentation Bulged at back	Do.	Do.
3.0	11.89	Needle point penetrated	Do.	Do.	Do.	Needle indentation. Bulged at back	Do.
3.5	13.15	Do.	Do.	Do.	Do.	Do.	Do.
4.0	14.97	Do.	Needle point just penetrated	Do.	Do.	Do.	Do.
4.5	16.25	Do.	Do.	Do.	Do.	Do.	Needle indentation. Bulged at back
5.0	17.93	Do.	Do.	Do.	Do.	Do.	Do.

Foundry Goggles—First Report

But the kinetic energy in this expression equals the work done on the moving parts (0.625 lb.).

Therefore:—

$$V^2 = \frac{64.4(2.5L + L^2)}{12 \times 0.625} = 21.45L + 8.58L^2.$$

From this formula the velocity was calculated at varying locations (L) and the results were used to draw the graph shown in Fig. 7. The slope of this curve is $\frac{9.3}{3}$ and the graph crossed the vertical axis at 2.3. The velocity for any given location may therefore be obtained from the following equation:—

$V = 3.1\,L + 2.3$ where V = velocity in ft. per sec.
L = location in in.

TABLE 20.—*Needle Test Machine. Results Obtained with 50 mm. dia. Acetate Specimens.*

Spring compression location (in.)	Specimen thickness, in.	
	0.050	0.080
1.5	Needle point indentation	Needle point indentation
2.0	Needle point indentation	Needle point indentation
2.5	Needle point indentation	Needle point indentation
3.0	Needle indentation bulged at back	Needle point indentation
3.5	Needle indentation bulged at back	Needle point indentation
4.0	Cracked right through by two cracks each approximately ¼in. long from impacted point	Needle point indentation
4.5	Cracked right through by two cracks each approximately ¼in. long from impacted point	Needle point indentation
5.0	Cracked right through by three cracks each approximately ¼ in. long from impacted point	Needle point indentation bulged at back

TABLE 21.—*Needle Test Machine. Results Obtained with Curved Allyl Resin Lens.*

Specimen.	Result.
1	Specimen subjected to one shot from 3 in. The only effect was indentation by needle point. Specimen given a further blow from 4 in. This second blow shattered the specimen into nine almost equal fragments
2	Specimen subjected to one shot from 4 in. Specimen shattered into nine almost equal fragments exactly as specimen No. 1

First Series of Tests

The results of the first series of tests are given in detail in Tables 18 to 24. This work has not yet been completed, but it is evident that once again the plastics lenses are superior to either toughened or laminated glass. It appears also that the various plastics respond differently to the tests but it has not been possible in the time available to determine the precise order of merit of the different kinds and types of plastics lenses.

Conclusions

The work has not yet been completed but sufficient has been done to lead the sub-committee to certain definite conclusions. (*a*) Toughened glass should not be used as protection against molten metal nor should it be used to guard against flying particles in foundries. (*b*) Laminated glass is always broken by the molten metal and often broken by flying particles. In some cases splinters fly off from the surface of the laminated glass which would be adjacent to the wearers' eyes. It could not be said that laminated glass is useless but those of the sub-committee who have seen the experimental work would not be comfortable again in using this material. The sub-committee hold the view therefore that laminated glass should not be used in foundries. (*c*) Plastics are greatly superior to glass in resisting penetration by molten metal. Much more work needs to be done in order to determine the suitability of the various plastics for use as goggles, but there can be no doubt that suitably-designed plastics goggles are infinitely better than glass goggles in resisting penetration either by molten metal or by flying fragments. (*d*) The tests available show that a laminated-plastics goggle was by far the best so far as physical protection is concerned. Many more aspects of the matter will have to be considered and much more work will have to be done but the experimental work to date indicates quite clearly that the laminated-plastics goggle is the one which provides the maximum degree of safety. (*e*) Molten metal does not appear to wet plastics surfaces but it does wet metal surfaces and glass surfaces and

TABLE 22.—*Needle Test Machine. Results Obtained Using 50 mm. dia. Flat "Perspex" Lens.*

Specimen.	Result.
1	Specimen subjected to one shot from 3 in. The needle made slight indentation but there was no sign of cracking. Specimen then replaced in test machine and subjected to second shot from 4 in. The needle struck exactly over the first shot and the specimen split into two almost equal parts

TABLE 23.—*Needle Test Machine—Results Obtained using Toughened Glass.*

Spring-compression location (in.).	Result.
1.5	Glass slightly chipped by needle at point of impact.
2.0	Completely shattered.
2.5	Ditto.
3.0	Ditto.
3.5	Ditto.
4.0	Ditto.
4.5	Ditto.
5.0	Ditto.

TABLE 24.—*Needle Test Machine—Results Obtained using Laminated Glass.*

Spring-compression location (in.).	Result.
1.5	No effect.
2.0	Needle point marked glass.
2.5	Both glasses cracked, and small splinters came off back face.
3.0	Ditto.
3.5	Ditto.
4.0	Ditto.
4.5	Ditto.
5.0	Ditto.

adheres to them. It appears at this stage, therefore, that plastics lenses should not be mounted in metal rims because molten splashes will adhere to the rim and may then set fire to the plastic. This aspect of the matter clearly needs further consideration and probably further experimental work.

Acknowledgments

The sub-committee is indebted to Mr. Hyslop for his assistance during the time that he remained a member of it; to Mr. Livermore of the Midland Motor Cylinder Company, Limited, for much continued encouragement; to Major Reid of the Ministry of Supply and to Dr. Holland of Triplex Glass Company, Limited, for technical discussions on particular aspects of the work and to I.C.I. Limited, B.X. Plastics Limited, Parmalee (G.B.) Limited, and Triplex Safety Glass Company, Limited, for specimens. (The Report bears the signatures of Mr. A. W. Bushell and Mr. W. B. Lawrie.)

(The Report concludes with a second Appendix in which Major A. M. Reid, B.Sc., describes the laboratory ballistic trials of goggle lenses referred to by the sub-committee in the above. To make the JOURNAL'S report on this important safety matter fully comprehensive, this section of the Report will appear, almost in its entirety, in a later issue.)

Asquith's Expansion Plans

During the last few years a policy of expansion has been followed by the Asquith Machine Tool Corporation, Limited, and a major expansion of the Halifax plants of William Asquith, Limited, Modern Foundries, Limited, and Geo. Swift & Sons, Limited, is now proposed as labour is more readily available in that town, states the chairman, Mr. R. W. Asquith, in his annual report. In this connection it is proposed to increase the ordinary capital to £1,050,000, and subsequently to offer one new 5s. share for every two held.

Additional factory space and new plant are primarily required to enable the group to undertake the manufacture of the larger types of machine tools; to enable the manufacture of certain of the group's products, at present undertaken outside under subcontracts, to be carried out by the group with a resulting reduction in production costs and an improvement in quoted delivery dates; and to make possible the manufacture of other types of machine tools now largely being imported.

Sales for the year ended September 30 increased by 20 per cent. but profit margins were reduced. Net profits were £321,460 (£328,809) after tax of £373,720 (£332,700). Ordinary distribution is raised to 30 (25) per cent.

RUBERY, OWEN & COMPANY, LIMITED—Mr. F. S. Mitman has joined the board and is relinquishing his directorships of several of the subsidiary companies.

BEANS INDUSTRIES, LIMITED—Mr. J. Harris and Mr. A. A. Hampson have been appointed to the board. Mr. Harris joined the company 31 years ago and has been secretary since 1951. Mr. Hampson was with the Standard Motor Company, Limited, the parent company, for 17 years, before being transferred to Beans Industries as general manager a year ago.

British Bronze & Brass Ingot Manufacturers' Association

The twelfth annual meeting of the British Bronze and Brass Ingot Manufacturers' Association was held last Tuesday at the Queen's Hotel, Birmingham. Out of the four members of Council due to retire this year, the following were re-elected: Mr. J. H. Barwell, J.P., Mr. J. N. Cohen (A. Cohen & Company, Limited), and Mr. R. Wood (Wolverhampton Metal Company, Limited). Mr. D. A. McGill (of City Casting and Metal Company, Limited) was elected in place of Mr. S. W. Platt, who did not offer himself as a candidate for re-election. Hence, the Council now consists, in addition to the above, of: Mr. R. Anderson (E. Chalmers & Company, Limited); Mr. E. Josephs (Leopold Lazarus, Limited); Mr. W. E. Laybourne (Sheffield Smelting Company, Limited), and Mr. G. T. Whitehouse (Metal Products (Willenhall), Limited). Mr. F. Baugh (Alexander Metal Company, Limited) was re-elected as president and Mr. T. C. James (Wolverhampton Metal Company, Limited) and Mr. J. H. Barwell, J.P., as vice-presidents. The auditors (Kemp, Chatteris & Company) and the secretaries (Heathcote and Coleman) were re-elected. (An extended report of the proceedings will be published in next week's issue.)

Rating Appeal Successful

The Institution of Mechanical Engineers, in Birdcage Walk, London, S.W.1, has been exempted from paying rates by a decision of the Lands Tribunal, given in London last week. The Institution had appealed against a decision of the Central London Local Valuation Court, which rejected its contention that it was exempt from liability for rates as a scientific society under the Literary and Scientific Societies Act, 1843. The valuation court had confirmed an assessment of £6,000 gross, £4,997 rateable value.

The president of the tribunal, Sir William Fitzgerald, said: "I accept the contention that the promotion of the development of mechanical engineering means the increasing of scientific data, so that you can do things in mechanical engineering by the application of discovered scientific principles rather than by intuition or guess." The president held that the Institution was instituted for the purpose of science exclusively, and the appeal would be allowed.

The valuation officer (Mr. T. S. Cane) and Westminster City Council were each ordered to pay half the costs of the Institution.

Iron and Steel Institute

The eighty-ninth annual general meeting of the Iron and Steel Institute, followed by a technical session, will be held at the offices of the Institute, 4, Grosvenor Gardens, London, S.W.1, on May 7 and 8, commencing at 2.45 p.m. on May 7. A members' dinner will be held at Grosvenor House, Park Lane, London, W.1, at 7.0 for 7.30 p.m. on the first day when the Rt. Hon Reginald Maudling, P.C., M.P., Paymaster General, has agreed to propose the toast of the "Iron and Steel Institute and Industry." Mr. P. van der Rest, president of the Groupement des Hauts Fourneaux et Aciéries Belges, will reply to the toast of "The Guests."

There is to be a special meeting of the Institute in Belgium and Luxembourg, in association with Journees Internationales des Siderurgie. The technical meetings open in Liège on June 18 to 21, and will cover "New Developments in Steelmaking."

Sheffield seeks Clean Air Control

Sheffield Local Authority seeks atmosphere control under the Clean Air Act and has been told by the Minister of Housing and Local Government that consideration can be given to an application by a local authority to control smoke, grit and dust at "scheduled works." This would include foundries, iron and steel, gas and coke and producer-gas works.

The Town Clerk, Mr. J. Heys, wrote as Clerk to the Sheffield and District Clean Air Committee, to Sir Peter Roberts, M.P. for Heeley, urging his support, and he has had a reply from Mr. Jack Bevins, Parliamentary Secretary to the Ministry. Mr. Heys protested that the Minister was reducing the powers of local authorities and their officers at a time when, armed with their powers under the Clean Air Act, they had for the first time some hope of exercising effective control.

It was pointed out that Sheffield has five qualified smoke inspectors, and they and their predecessors in office have been undertaking smoke-abatement work for 50 years in the city. The Sheffield committee, too, has the unique advantage in having available to them the technical resources of the department of fuel technology at the University.

Mr. Heys referred to section 17 of the Act which, he said, "gives the Minister power to give back to a local authority smoke control powers in relation to processes controlled under the Alkali Acts."

Mr. Bevins has said, "The Minister will be prepared to consider an application by a local authority for such an order, but under the terms of the section he must be satisfied before making an order that in all the circumstances it is expedient to do so. It will be necessary to inquire into such matters as the nature of the works or processes included in the application, and the technical resources of the local authority, and to seek the views of the industry concerned as well as those of the local authority submitting the application."

Machine Tools for Schools

Ayrshire Education Committee have been told by H.M. Inspector of Schools for Technical Subjects that their programme for the installation of machine tools in technical schools is not being carried through quickly enough. In a report to the committee, Mr. A. B. Cameron, deputy director of education, has stated that as a result of this comment the committee's supervisor of technical subjects has surveyed the equipment in all secondary schools and has listed the deficiencies against the Scottish Education Department's standards.

He has costed the required items at current prices, reaching the following totals: senior secondary schools, 1958-59, £7,000; large junior secondary schools, 1959-60, and 1960-61, £11,250; small junior secondary schools, 1961-62 and 1962-63 and 1963-64, £17,000. By 1961, Mr. Cameron said, the Scottish Education Department hope to establish a school-leaving certificate examination at the fourth year stage and it is anticipated that the practical examination in technical subjects will require the use of the machine tools allowed for in this budget.

A CLOSER LINK with Lincoln industry and Lincoln Technical College has been made by the re-introduction of the Lincoln Building and Engineering Advisory Committee, formed in 1932 to advise governors of the College on matters relating to the education of engineering students. There are 3,036 students at the College.

International Standards Organization

Several hundred industrial leaders, engineers, scientists and other specialists from 40 countries are to meet in Harrogate in June for the 1958 assembly of the International Organization for Standardization (ISO). It will be the first time the ISO assembly has been held in Britain; previous meetings were at Stockholm (three years ago) and before that in New York and Paris. The 1958 series of meetings of the full assembly, of the ISO Council, and of 15 specialized technical committees, will be opened on June 9 by the organization's president, Sir Roger Duncalfe, and will continue until June 21. Arrangements are being made by the British Standards Institution.

The vital role which industrial standards are playing in helping trade between nation and nation, and such developments as the proposed European Free Trade Area, lend a special significance to the Harrogate conference. As national standards are increasingly applied to stimulate productivity and general industrial efficiency, so it becomes ever more important in export trade that the standards of one country should not be in conflict with those of its customers and suppliers in another, ISO's *raison d'être* is to smooth out differences between the national standards of different countries.

The work of formulating international standards is carried out by ISO's 85 specialized technical committees. Fifteen of them will be meeting at Harrogate, and the subjects under discussion will include cast iron, steel, copper, light alloys, and certification marks.

An appeal for funds has gone out to the British industries whose standards are likely to be involved at meetings of the above technical committees and it is hoped that the response to this appeal will reflect industry's growing use of standards, especially in the field of export trade.

Wilmot Breeden Fellowships

The Wilmot Breeden group of companies, whose manufacturing interests include motor vehicle and gas-turbine components, are sponsoring two Fellowships, each worth £1,000 per annum, one at the University of Birmingham and the other at the College of Technology. An unusual feature is that the successful candidates will divide their time between the University or College and the company. The terms of the awards are so arranged that at any one time there will be a Wilmot Breeden Fellow working in association with the University and another with the College. The Fellowships will be advertised every year in March, in "odd" years in association with the University and in "even" years in association with the College. Each Fellowship will normally be held for a period of two years. A candidate for a Fellowship should normally have had two or three years research or industrial experience. He must be acceptable to the academic authority and would be expected to have an honours degree in a university in the British Commonwealth, a diploma in technology, or an equivalent qualification. An application for a Fellowship should outline a two-year investigation or project on which the candidate seeks to work.

THE EXPORT CREDITS GUARANTEE DEPARTMENT announces that its office in the City of London moved to larger premises at Marlon House, Mark Lane, London, E.C.3 (telephone: Royal 3491) on March 17.

Equipment & Supplies

Accessories for Moulding

A visit to the works of George Tweedy & Company, Limited (referred to recently in this JOURNAL) revealed that this firm is making for sale by their sole agents, British Foundry Units, Limited, Retort Works, Chesterfield, a number of items of foundry plant, amongst which are two new lines, brief particulars of these being as follow:—

Blacking and Slurry Mixers

Two sizes of a foundry blacking, plumbago-wash, paint and slurry mixing machine (shown in Fig. 1) are being produced. These deliver 2 and 5 gall. respectively of mixed material and it is claimed that to prepare these quantities sufficiently emulsified involves but a 5- to 10-min. operation. The equipment consists of a cast-iron base on which is mounted a single-phase motor directly driving (through a special seal) a vaned rotor, running on a horizontal axis and located inside the tip-up galvanized cylinder containing the material to be mixed. As it is often held that 24 hours soaking is necessary as a preliminary to the old method of preparing a blacking suspension by hand, it would appear that the new machine has much to commend it. A much-enlarged edition of the same device—of 20-gall. capacity—is also available. This consists of a fixed rectangular galvanized tank, open at the top, and fitted with a draw-off valve. The machine caters for the continuous blacking or slurry needs of large foundries. It employs a steel pulsator, driven by a ½-h.p. motor, projecting into the side of the tank. It is claimed that admixtures of up to about 30 per cent. solids in a liquid can be rapidly and effectively converted into emulsions by either type of machine. Another advantage is the possibility of continuous agitation of the blacking or other suspension at very low cost, plus the ability to re-emulsify in a very short period should the powder material settle out overnight.

FIG. 1.—*Blacking mixer developed by George Tweedy & Company, Limited. The model shown—of 5-gall. capacity—is pivoted for delivery and the mixing motor, which is mounted integrally with the drum, cannot be seen.*

Portable Knock-out and Sand Aerator

The item shown in Fig. 2 is an extremely robust device incorporating the several foundry operations of knocking-out, sand riddling, throwing and aeration in one portable machine. Mounted on cast-iron (or rubber-tyred) road wheels and weighing but 5 cwt., it may be moved barrow-like around the foundry, the sole requirement being a flexible lead for single or three-phase electricity supply. Knocking-out of cast-up moulding boxes (up to 21- by 12-in. size) is effected by placing them on a dump frame inside the hopper at the top of the machine. This frame is mounted on springs and vibrated mechanically from the electric drive. The castings thus released are retained on dump bars across the frame and the sand falls through a riddle, also vibrated. Beyond the riddle, the falling sand encounters blades of a paddle-wheel rotating at very high speed which throws it through another screen having a vertical wire mesh, the distance travelled by the delivery stream of sand reaching anything up to 20 ft. The result is well-aerated sand, free from lumps, and ready for immediate use. It can be piled as required against a wall close to a moulder's bench. Alternatively, the machine can be used for treating floor sand, the latter being shovelled into the hopper as the machine is wheeled to different locations. In this case, new sand, coal-dust and water additions can be made if necessary to knocked-out sand on the foundry floor and the whole roughly mixed by shovel before putting through the machine. The mechanical parts of the machine appear to be well guarded and simple vee-belt drives from the single motor are arranged.

A.E.I. LAMP AND LIGHTING COMPANY, LIMITED, of Melton Road, Leicester, announce a new dustproof 5-ft. single-lamp fluorescent fitting for use in collieries, textile mills and timber mills. The fitting was originally designed for mines roadway lighting and general industrial applications.

FIG. 2.—*"Vortec" portable knock-out and sand aerator.*

Company News

LAPORTE INDUSTRIES, LIMITED—The company has acquired a majority interest in Pembina Mountain Clays, Limited, Winnipeg, which has similar interests to the Fullers' Earth Union, Limited, a UK subsidiary of Laporte Industries.

MANGANESE BRONZE & BRASS COMPANY, LIMITED—A final dividend of 10 per cent. plus a bonus of 2½ per cent. on the £1,108,268 ordinary capital as increased by a one-for-one scrip issue, is recommended, making a total equivalent to 16¼ per cent. on the enlarged capital for 1957. For the previous year a total of 27½ per cent. comprised interim 7½ per cent. on £454,134 capital and final 17½ per cent. plus bonus 2½ per cent. on £554,134 after the issue of shares against the acquisition of Lightalloys, Limited. Group net profit for the year is £271,553, compared with £246,856, after taxation of £346,713 (£289,570).

KAY & COMPANY (ENGINEERS), LIMITED—It is proposed that a new company be formed under the name Kay & Company (Engineers), Limited, to purchase the manufacturing side of the business, and that the parent's name be changed to Alenco, Limited. As a consequence of the announced retirement of Mr. F. Kay and Mr. N. Kay, and of the new organization, Mr. J. Symes has been appointed managing director, and Mr. J. A. Dale managing director designate of the proposed operating subsidiary. Mr. S. A. Gardner has succeeded Mr. Dale as secretary. An extraordinary meeting is being held on March 21.

EVERED & COMPANY, LIMITED, brass and copper tube makers, brassfounders, etc., of Smethwick—An unchanged final dividend of 10 per cent. is announced, making 15 per cent. (same) for 1957 on the £500,000 ordinary capital. Net balance stands at £107,329, against £124,485, owing to trading profits dropping from £258,954 to £227,860. CIC permission is to be sought to capitalize £250,000 of general reserve to make a one-for-two scrip issue of ordinary stock. The company states that unless profits and trading conditions improve considerably it does not anticipate paying more than 10 per cent. for 1958 on the increased capital, equivalent to the 1957 total.

FLUIDRIVE ENGINEERING COMPANY, LIMITED—The value of orders booked by the company in 1957 was 29 per cent. higher than previously, and exports rose by 18 per cent., says Mr. H. Sinclair, chairman. Canada was the biggest market. With regard to borrowing arrangements, the bank has agreed to raise the overdraft limit by £75,000. The directors now state that a further advance of £65,000 has been made by Industrial & Commercial Finance Corporation, Limited, increasing the secured loan to £200,000, repayable £15,000 per annum with a final instalment of £20,000 due in 1970. It is hoped that this extension of credit will satisfy financial requirements at least for a year or two. Group net profits in 1956-57 of £103,062, compared with £105,980. The dividend of 10 per cent. on £400,000 goes against 15 per cent. previously, of which the 10 per cent. interim was paid on £125,000.

PLAQUES HAVE BEEN PRESENTED to 50 employees with 40 years' service with Samuel Fox & Company, Limited, steel manufacturers, etc., of Stocksbridge, near Sheffield, by Mr. J. D. Joy, a director and works manager. Seventeen others with 50 years' service were presented with certificates. Since 1946, when the long-service presentation scheme began, the company has awarded 698 plaques and 198 certificates.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference ESB can be obtained from the Board of Trade Export Services Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone: CHAncery 4411, ext. 738 or 771), unless otherwise stated.

BURMA, March 25—Hot-plate units of the embedded resistor type I.K.W. 220 v. 12 by 8 in. (ESB/6475/58.)

VENEZUELA—Aluminio de Venezuela S.A., Edificio Paris 8-2, Plaza Urdaneta, Caracas, wish to take on the exclusive representation of United Kingdom manufacturers of aluminium hardware (*e.g.* door knobs) of modern design. (ESB/6125/58.)

MORPETH, March 24—Providing and laying about 120 lin. yd. of 14-in. dia. cast-iron pipe pumping main. Applications to D. Balfour & Sons, consulting engineers, Caledonian Buildings, 145, Pilgrim Street, Newcastle-upon-Tyne, 1, accompanied by cheque made payable to the above Corporation.

GUILDFORD, April 3—6-in. dia. soil sewer and appurtenant works for Rural District Council. Documents from J. W. Snape, Millmead House, Guildford. Deposit £2 2s.

WILLITON, April 28—Requirements include 738 yd. of 12-in. dia. spun-iron sea outfall. Documents from the Engineer and Surveyor, Mr. S. E. Balch, Council Offices, Fore Street, Williton, Taunton, Somerset. Deposit £3 3s.

KING'S LYNN, March 28—Construction of 115 lin. yd. of 2-in. dia. cast-iron water main together with appurtenant works. Documents from Borough Engineer, Clifton House, 17, Queen Street, Kings Lynn. Deposit £2 2s.

ROSS AND WHITCHURCH, April 11—Construction of approximately 22 miles of spun-iron water mains, 6-in., 4-in., 3-in. and 2-in. dia. Contract No. 4 for R.D.C. Documents from the engineers, A. H. S. Waters & Partners, 25, Temple Row, Birmingham, 2, or H. B. Reynolds, Clerk of the Council, Woodside, Ross-on-Wye. Deposit £5 5s.

PHILIPPINES—Overseas Investment Company, Limited, 1501 A. Mabini, Manila, agents for American Machinery and Parts Manufacturing Company, Inc., P.O. Box 2493, wish to receive quotations from U.K. manufacturers for the following induction-type electric furnaces with all controls:—One of 2,000 lb. capacity for cast iron; one of 3,000 lb. capacity for cast steel, and one of 1,000 lb. capacity for non-ferrous metals. Also supporting foundry equipment—sand miller, moulding machines, core-blower, etc.

Forthcoming Events

MARCH 24

Institution of Works Managers

Glasgow branch: "Radio Isotopes," by Henry Seligman, Ph.D., 7.30 p.m., at the St. Enoch Hotel. (Joint meeting with the Glasgow branch of the Institution of Production Engineers.)

MARCH 25 to 27

Institute of Mechanical Engineers

Conference: "Technology of Engineering Manufacture," at 1 Birdcage Walk, Westminster, London, S.W.1. (Details from secretary.)

MARCH 26

Institute of British Foundrymen

Birmingham branch: "Practical Foundry Techniques," by G. H. Haynes, 7.15 p.m., at the James Watt Memorial Institute, Great Charles Street.

London branch: "Patternmaking Progress," by B. Levy, 7.30 p.m., at the Constitutional Club, Northumberland Avenue, W.C.2.

MARCH 27

Institution of Works Managers

Lancaster group: "Human Factors in Work-study," by T. Lupton, 7.30 p.m., at the Royal King's Arms Hotel, Lancaster.

MARCH 28

Institute of British Foundrymen

West Wales section: "Some Aspects of Production in a Steel Foundry," by J. G. Bailes, 7 p.m., at Richard, Thomas & Baldwins, Limited, Landore, Swansea

MARCH 29

Institute of British Foundrymen

Wales & Monmouthshire branch: "Some Aspects of Production in a Steel Foundry," by J. G. Bailes, 6 p.m., at Courtybella Works Club, and Institute, Cardiff Road, Newport.

On Visiting Foundries in America . . . .

Personal observations from one of the JOURNAL'S lady reporters

Three Statements

"We always use women as die-casters if they want the job," said the industrial relations manager of a large foundry at Lenoir, the small town in Tennessee, which is rapidly growing as American firms build new factories in rural settings where land is cheap and easily available. "The women get the same rate for the job," explained a supervisor in artisan Philadelphia, where the engineering concerns stand cheek by jowl as they do in industrial Staffordshire or Tyneside. "There is no 'problem' about coloured labour—the negro who has the necessary skills and crafts works alongside the white operative," commented a plant manager in Chicago, where the automobile workshop is the predominant feature of the industrial scene and where the infiltration of coloured labour is considerable.

A New Viewpoint

In Connecticut . . , in Buffalo, near which the roar of Niagara booms for miles . . , in lush Virginia, where factories lie amid cornfields . . , in Detroit . . in Birmingham, Alabama . . in towns in many parts of the United States and Canada, the writer visited industrial plants, she saw workshops and watched operatives, not with the eye of a production or productivity observer, but to absorb the atmosphere of the shop floor in the foundries and machine shops of American plants. US "housekeeping" reaches a very high standard; America generally is acutely hygiene conscious. In the streets of New York, garbage collectors and road-sweepers pounce ceaselessly on all errant paper and litter scraps—and police likewise have the power to pounce instantly on anyone seen to be scattering litter! In the drug stores, cafés, steakhouses and coffee shops, hygiene is raised to a standard that fills the European visitor with admiration and envy. This attitude is translated directly to the factory shop floor and foundry housekeeping is no exception in maintaining this high level of efficiency.

Industrial relations in the US has a different "climate" from the British; there is a marked element of "bringing in everybody on the act." As the writer walked around the workshops of one plant in Niles, on the shore of Lake Michigan, there was posted prominently on every noticeboard this message:—"This day we welcome a visitor from England who is "—etc. etc. (giving full details). It was an interesting point. How often in this country do visitors move around only to arouse the unsatisfied curiosity of operators at whose activities they stand and stare! On the contrary, there is in America much less employee counselling than in British personnel management practice. Amenities and "fringe" benefits provided by firms are, in the main, generous and of greater variety than in Britain (a library is provided for the children of employees, for instance), but "welfare" rarely extends to the assistance with the personal problems that personnel managers here count it amongst their terms of responsibility to assist with. In the foundries visited the standard of atmosphere control and ventilation was very high. That is probably one of the reasons why there is so high a percentage of female labour in some American foundries.

"Accent on Aptitude"

There is also considerable preoccupation by executives on selection techniques and operator training so that in the American plants there is less likelihood of a "square peg" being put into a "round hole." There is elaborate record keeping and analysis of labour turnover as well as computation of the all-important economic ratio between direct and indirect labour costs. On the other hand, the codes of safe-working practices are not nearly so elaborately defined as in British plants. In all the plants inspected—in places as far apart as Salem in Virgina, Boston, Valley Forge, New England, Memphis and Stamford, Connecticut—operators (mainly women) worked machines with exposed spindles, the safety device being wristbands thonged so that the hands were pulled back when put into a dangerous position. But the device meant that the operative had, personally, to affix the protective kit to her body. Thus, in the States, the onus of working safely rests heavily on the operator himself. The domestic background to the workshops is impressively good; much use is made of automatic vending machines, which are specially popular in the metalworking industries. Furnacemen, knockers out, cupola men and others on "hot" jobs frequently move to take a "coke" out of a vending machine nearby.

Working to Scheme

The tendency in workshop design is inevitably towards the layout of a big area which facilitates the flowline of the automatic theme of production. The average working week in all the plants visited was 40 hours. Trade unionism is strong and influential, but the system is organized on a local basis. The unions make a domestic contract of one, two or at most three years. The companies deduct the union dues. The number of shop stewards does not exceed one per foreman. American industry does not have the problems of the very young

On Visiting Foundries in America . . . .

workers. No person under 18 may be employed in a factory workshop in the US. Again, that is probably one of the reasons why female labour is more in demand and in more varied application; most of them are well satisfied with their jobs.

There appears to be more use of job-evaluation in foundries in the States than in this country and there is also more application of job appraisal. As for the "tempo" of American plants, famed for its high level, it did not seem that it was in any way greater than that in UK plants where production control has been well defined. There is much more "automation" and more mechanization in the States, which means a higher degree of productivity, but technically they have "not much on us," it would seem. But for shop-atmosphere, presentation of the job from the angle of employee satisfaction, that is a field where transatlantic practice seems to surpass that of UK plants.

Parting Shots

"Hiya," said the female die-caster as our party watched her deftly at work in Gallatin, Tennessee, and, "you're welcome," said the girl viewing the rough cast-metal components, when asked for one to examine.

In American shops they are friendly and at ease. "Communications," that blanket term for many things, but which includes keeping employees informed about what goes forward, are good—there was much job satisfaction to be seen on the "other side of the pond!"

Northern Aluminium Expansion Plans

Preparations for the second phase of the plan to extend the Monmouthshire works of the Northern Aluminium Company, Limited—the UK subsidiary of the Canadian Aluminium, Limited—were announced by the chairman of the company, Lord Alexander of Tunis, last week. The intention is to spend £8,000,000 in the next four years on plant and buildings to increase annual capacity from 50,000 tons to 75,000 tons, and to pave the way for a further increase if necessary, at a relatively low cost per ton, to an ultimate capacity of 175,000 tons.

Developments are to be financed mainly by subscription of £3,000,000 in new ordinary share capital by the parent company and a long-term loan of £3,000,000. The balance will be found from retained earnings and depreciation.

More efficient production methods had become essential, said Lord Alexander, and the company believed its aim could best be achieved by a large modern rolling mill with a high rate of throughput coupled with the necessary flexibility to handle the diversity of light-alloy products demanded by industry to-day. Wider and longer plate in aluminium and its medium strength alloys would become available to meet the needs of the shipbuilding, chemical, atomic energy, and similar industries. Larger sizes of medium-strength alloy sheet would also be offered for the more economic construction of road and rail vehicles and for general engineering.

Principal additions to the plant would include a 12-ft. wide hot mill and the introduction of hot coiling under tension direct from this mill.

Customs of the Trade

By T. R. Harris

During the period from the commencement of the Industrial Revolution to the present time there have grown up a number of "Customs of the Trade," by which business is regulated. In some cases, to avoid misunderstanding, such customs are printed on the form of tender* submitted by the party engaging to perform the contract. Occasionally this is not done and misunderstandings arise so an appeal is made to the more general customs of the trade.

A reference to this is to be found in a letter dated August 18, 1837, addressed to the Adventurers in the Wheal Gilbert Mines, Penzance, Cornwall, and written by Geo. Crane of the Ynisndwyn Iron Works, Swansea. The letter was in reply to one from Captain K. Vivian, the manager of the mine, claiming an allowance on the amount of the bill submitted for sundry iron castings supplied to the mine. The allowance was claimed for the amount charged for the patterns.

"These were," wrote Crane, "made expressly on purpose to mould your castings from, which we perceive we charged (*and cost us*) in the whole £28 15s. 6d." "With regards to your objection to our charge for patterns," he continued, "and Captain Vivian's intelligence that it is customary to find patterns in Cornwall, of which, until named by him we knew nothing, we must observe that such is not the practice on this side of the water, and we must be excused in adding that if we were to order copper ore, or tin, from you, if we did not make any stipulation previously, to the contrary you would maintain, and justly maintain, that we were bound both in Law and Equity by the custom according to which such articles were usually sold in Cornwall. We do not make charges sufficiently high to enable us to find patterns. It is by no means an unusual case that a pattern will cost more than the casting itself can be charged."

Proposed Solution

It was further stated that the prices charged for the actual castings were less than contract prices, because of "the delay which arose from a variety of accidents not to be controlled here" and that a further reduction was quite impossible "the rise and fall of a market cut both ways, the buyer and seller must take their respective chances."

After a detailed comparison of the prices ruling at the time the various castings were ordered with those charged, the writer concludes, "When we commenced this letter we intended to have closed it by stating that (keeping ourselves *without prejudice distinctly* in the event of our not receiving an early remittance to close the transaction upon these terms) we would divide the *cost* of the patterns £28 15s. 6d. to endeavour to give you satisfaction, if we were, however, to conclude that you will order any further castings which you may hereafter require of us from the patterns made expressly for you we will allow the whole sum *viz.*, £28 15s. 6d.

"We can readily perceive after the explanation given that *you* were not aware of our rule in Wales upon the subject; that you were not so we regret. In any further order with which we may be favoured other than from the patterns which we have by us, we will take care that you are properly advised of the charges of patterns before any such are incurred."

* Whilst buyers may object to the printed Conditions of Sale, that system is preferable to reliance on Custom of the Trade.—*Editor.*

New Patents

(Copies of complete specifications are obtainable from the Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2, price 3s. 6d.)

787,052. Rolls-Royce, Limited, Nightingale Road, Derby.

Improved moulds for castings. A coating is applied to an expendable pattern of wax or of a material of relatively low melting point such as tin/bismuth alloy, polystyrene, or cellulose acetate. The coating comprises a finely-divided refractory material suspended in a liquid containing ammonia and sodium or potassium silicate or a mixture of both in solution, the solution containing sufficient water to prevent precipitation of the silicate by dehydration; and hardening the coating afterwards by the application of carbon-dioxide. The coating may be applied to the pattern as an initial coating or may be applied after the pattern has first been coated with another material according to current practice.

By building up a relatively thick shell by a series of coats, and hardening each coating as mentioned before, and by dusting each wet coating with a refractory, a shell mould may be produced with sufficient rigidity to enable it to be used by itself for casting. However, it is preferably supported in a coarse refractory powder such as sillimanite or fireclay grog (through a 10 mesh sieve). This powder may be bound by a fritting agent such as anhydrous sodium silicate, sodium nitrate, sodium silico fluoride or ammonia phosphate.

787,098. Rheinische Kalksteinwerke. G.m.b.H. Wülfrath, Rheinland, Germany.

A process for the introduction of fine substances into baths of molten steel within a converter. It is done by means of an oxidizing gas through a lance on to the surface of, or below the surface of, the steel bath. Lime or hydrated lime in the form of dust or powder is blown on to, or into, the bath.

787,276. George Hickman, "Leoma," 34, Vicarage Road, Coseley, Staffs.

A mechanism for handling moulding boxes on foundry moulding machines. It is particularly, though not exclusively, applicable to moulding machines of the direct-draw type, in which the moulding box together with the sand mould is lifted off the pattern on the moulding-machine table by means of vertically sliding points, jaws, or frames.

787,402. Coleman-Wallwork Company, Limited, Stotfold, Arlesey, Beds.

Improvements in foundry moulding apparatus. It is aimed to permit of the rapid automatic production of half moulds, or of moulds, from the supply of empty boxes to the closing of the finished mould. The invention also claims to provide a form of the apparatus which allows a high rate of production of moulds with a single pattern, one and the same pattern-plate being used repeatedly for the production of a succession of moulds.

787,441. Brassert Oxygen Technik AG. Zollerikerstrasse 93, Zollikon-Zurich, Switzerland.

A process for refining pig-iron containing more than 0.2 per cent. of phosphorus, by blowing oxygen at, or into the surface of, the bath. The combustion of the phosphorus is accelerated by adding ore or millscale, lime and flux.

Notes from the Branches

Lancashire

The Lancashire branch of the Institute of British Foundrymen held a meeting at the Midland Hotel, Manchester, on March 3. The lecturer, Mr. J. D. Leishman (as Mr. E. H. Beech, branch president, said when introducing him), was well qualified to speak on the subject of "Malleable Cast Iron" since the firm with which he is connected (Harrisons, Limited, of Lincoln) produces 270 tons of this material per week. Mr. Leishman included in his paper a detailed description of the chemical reactions which took place in the processes involved in the manufacture of malleable cast iron, and clearly demonstrated these by the use of numerous diagrams. A vote of thanks to the lecturer was proposed by Mr. E. Longden and seconded by Mr. R. L. Handley.

Discussion

In the discussion which followed presentation of the paper, MR. HARPER asked why an annealing oven, shown in one of the illustrations, contained no packing cans; he also wanted to know how very small castings would be dealt with in the annealing section.

In reply, MR. LEISHMAN said that no packing cans were required with gaseous annealing. With the old pack-annealing process, the hematite ore supplied the oxygen to decarburize the castings. However, the electric ovens were gas tight and decarburization was effected by gases generated between the castings themselves and added steam. Very small castings needed support and where sizes in a furnace load differed considerably, the smaller ones were placed on top.

MR. TAYLOR asked was there any danger of gas pick-up when the inspection doors were opened to remove slag, etc.

MR. LEISHMAN said slight gas pick-up did take place but this was not detrimental.

The meeting concluded with a second vote of thanks from the chairman who remarked that he was sure everybody present had derived some benefit from the lecture.

London

The annual "Men Only" dinner of the London branch was held on March 7 at the Duke of York's H.Q., Kings Road, Chelsea. A most enjoyable evening was spent by some 160 members and their guests. (The number is somewhat lower than the average of a few years ago probably as a result of decreased attendances from the membership of the London sections which now organize their own social functions.) After the "Loyal Toast," Mr. John Blakiston, national president of the Institute, proposed the toast of "The London Branch," to which Mr. A. Talbot, president of the London branch, replied. Mr. A. R. Parkes, honorary secretary of the London branch and president of the Slough section, proposed "The Guests" and Mr. R. E. Berry, president of the East Anglian section, responded. The speeches were kept short, so as to preserve the informal nature of the proceedings. During the evening members and guests were entertained by the Four Aces Concert Party.

THE NAME OF THE CANADIAN SUBSIDIARY of George Kent, Limited, Luton, formerly Kent-Norlantic, Limited, has been changed to George Kent (Canada), Limited. The address for the offices and plant remains unchanged at 389, Horner Avenue, Toronto, 14.

Book Reviews

General Galvanizing—A Manual of Costing Practice, 2 Vols. Published by the Hot Dip Galvanizers' Association, 34, Berkeley Square, London, W.1, price 35s., post free.

Whilst there are galvanizing departments in some foundries, usually for malleable cast-iron fittings, it is not a widely used process in the foundry industry. Thus for a foundry, costing for the galvanizing shop becomes a departmental affair and not a proposition for the whole concern. Many foundries, of course, send out their castings to be treated. Whilst the book is a committee publication, it has been prepared by Mr. W. E. Harrison, who is well known as one of the authors of a publication by the Council of Ironfoundry Associations for the costing of iron castings. The present book is divided into two parts, the second of which carries 28 tables of an explanatory type. Even though, so far as foundries are concerned, galvanizing is a departmental matter, it is just as well to ascertain true costs.

Zeliwo Sferoidalne (Nodular Cast Iron), in Polish, by J. Piaskowski and A. Jankowski. Published by Panstwowe Wydawnictwa Techniczne, Warsaw.

The book, of 232 pages, is a very comprehensive review of literature on nodular-graphite cast iron appearing on both sides of the "iron curtain," containing some 238 references. It is intended primarily for foundrymen, but will be useful to mechanical engineers and students of foundry technology. It outlines the classification and chemical composition of nodular-graphite cast iron, the theoretical basis of crystallization of graphite, the methods of production, and apparatus used. The technology of production of castings in the material and their thermal treatment is discussed and information is given about the properties and applications of nodular cast iron.

The authors' treatment of the methods of production is practical, outlining the type of raw materials, chemical composition of different grades of iron, methods of desulphurizing and enumerating the compositions of some 13 magnesium alloys used. They discuss the factors affecting the retention of magnesium and mention the effect of cerium, and also the effect and suitability of various types of inoculant. The methods of melting and preparation of magnesium additions are dealt with at some length and formulas for calculating the amount of magnesium required for nodular-graphite formation are given. Production methods of melting nodular iron in the cupola—arc and induction furnaces—are described. Methods of adding magnesium in the form of alloys, rods made of electrode scrap, and powder and vapour, are described at some length, with explanations of the physical and chemical processes involved. Some experimental methods are also outlined.

There is a short chapter on quality control in production, dealing with all the stages from control of quality of raw materials to the final product. The third section, dealing with technological properties of the iron, has an informative chapter dealing with fluidity, solidification, contraction, tendency to form shrinkage defects, and factors leading to internal stresses. There is also a useful chapter on the design of castings, dealing with the effect of change of sections, methods of gating, calculating the size of feeders from the shape factors of the casting and metal composition, showing examples. Means of increasing casting yield are described. The fourth section deals with the practical heat-treatment, giving theoretical explanations and various surface treatments, and the fifth deals comprehensively with the physical properties and applications of nodular cast iron.

To those able to read Polish, this book is a very useful compendium of information on all aspects of nodular cast iron. Whilst technical opinion in this country may not be entirely in agreement with that of the authors on all details, the book provides useful information on the contributions made to the subject in eastern Europe and Russia and shows an excellent knowledge of the problems arising in the production of this material.

T. J. SZAJDA.

Publications Received

Safety—The Magazine of Accident Prevention and Health, No. 1. Published by the British Iron and Steel Federation, Steel House, Tothill Street, London S.W.1.

It is thought that this is the first time an industrial organization has ever ventured upon the publication of a magazine purely in the interests of the safety of its employees. It is reported that the accident incidence in the iron and steel industry is 2.74, but at Scunthorpe it is down to 1.28; in other districts it rises to 3.71. Thus, wisely, the first article in this booklet is devoted to the safety organization at Scunthorpe. As statistics show the majority of accidents are due to falling bodies, an article is based on the notion that half of the acidents are preventable through the use of helmets. Large-scale experiments have been carried out on the use of helmets in the industry, but not with outstanding success. One article makes a survey, relating accident frequency with numbers employed by firms, and it is shown that the largest and smallest steelworks are the safest. In another article, the subject is related to departments or operations, and when comparing the figures tabulated for accidents arising in each of 24 departments in two yearly periods, red and green spots are used to indicate deterioration or improvement.

Under a report on measures taken in Holland, there is a full-page picture of Mr. F. W. E. Spies, general works manager, Royal Netherlands Blast Furnaces and Steelworks, Ijmuiden (past-president of the International Committee of Foundry Technical Associations); it will be news to many foundrymen to learn that he is an outstanding protagonist of the safety-first campaign in his country, and the safety record of his works is reported to be excellent. The new magazine is well produced, splendidly illustrated and deserves the success its high ideals merit.

Training, No. 32. Issued by the British Iron and Steel Federation, Steel House, Tothill Street, London, S.W.1.

This magazine is issued three times a year and covers training activities in the iron and steel industry. There is much to be learnt from this publication and the reviewer gives high priority to the fact that there are no fewer than six training officers on the staff of the Federation as against one for the whole of the iron foundry industry. In addition, individual works operate their own schemes, and in this issue there are articles on the new staff training college at Stoke D'Abernon in Surrey, organized by Richard Thomas & Baldwins, Limited, and on the operative training scheme of the Appleby-Frodingham Steel Company. It is obvious that the iron and steel industry is well in advance of the foundry industry in training both operatives and staff to ensure that their works will be more efficient in the future.

News in Brief

THE CANADIAN SECTIONAL MEETING of the World Power Conference is to be held in Montreal from September 7 to 11.

FOR THE FIRST TIME in some 20 years no overtime is being worked at the Holwell Works, Melton Mowbray, of the Stanton Ironworks Company, Limited, where some 1,500 workers are employed. The normal working week is being maintained.

TO MARK the 25th anniversary of its incorporation as a limited company, Britannia Iron & Steel Works, Limited, Bedford, has prepared an illustrated booklet dealing with the history and progress of the company. An open day is to be held later this year.

FIRST FIVE PLACES in the essay competition organized by the Sheffield Area Industrial Group of the Society for the Prevention of Accidents were won by apprentices of the Chapeltown works of Newton, Chambers & Company, Limited. Forty of an entry of 127 were apprentices.

BRITISH STANDARD NO. 1211:1958 "Centrifugally cast (spun) iron pressure-pipes for water, gas and sewage" appears under the heading of "Revised British Standards" in the February issue of *B.S.I. News*. It corresponds generally to B.S. 78:1958 which covers vertically-cast pipes.

EXAMPLES of the leading makes of British record players, each using Salter fasteners, will be shown by Geo. Salter & Company, Limited, of West Bromwich, at the Radio and Electronics Components Manufacturers' Federation Exhibition at the Grosvenor House Hotel, London, from April 14 to 17.

FOLLOWING THE RECEIPT of a petition from 150 local people complaining that the proposed site for a coke-oven plant at South Bank-on-Tees was too close to their houses, the South Durham Steel & Iron Company, Limited, is preparing a revised scheme re-siting the plant farther away from residential property.

APPRENTICES of the Sir W. G. Armstrong-Whitworth (Aircraft), Limited, Coventry, have built a replica of the glider in which the aviation pioneer, Percy Sinclair Pilcher, crashed and died nearly 60 years ago. It is to be presented by the Royal Aeronautical Society to Lord Braye at Stanford Hall, Rugby, on March 26 for his Pilcher Museum.

A HIGHLY CONTROVERSIAL SUBJECT—the effect of automation and mechanization on labour relations—is the theme of a paper to be presented by Mr. W. B. Beard, O.B.E., a member of the T.U.C. General Council, and secretary of the United Patternmakers' Association, at the Materials Handling Convention at Earls Court, London, May 7 to 17.

PHILIPS ELECTRICAL, LIMITED, of Century House, Shaftesbury Avenue, London, W.C.2, will exhibit their X-ray analytical equipment, electronic circuit panel, high- and low-angle diffractometer, and a number of other instruments at the exhibition of the Physical Society to be held from March 24 to 27 at the Royal Horticultural Society's Halls, Westminster, London.

EIGHT RINGERS made the third attempt to ring a world record of 40,320 changes at Taylor's Bell Foundry, Loughborough, on Saturday, March 8, but after 10 hours when 21,800 changes were rung, the conductor, Mr. Robin Leale, of Surbiton, Surrey, had to call a halt because he felt ill from fatigue. This is claimed to be the highest number of changes rung by one band.

WALKER, CROSWELLER & COMPANY, LIMITED, of Whaddon Works, Cheltenham, announce the introduction of the Unatap spray mixing-tap type 3. The basic design proved an immediate success when it was first put on the market a year ago, and the new type embodies the modifications that national use has suggested. The Metropolitan Water Board has officially accepted the design.

A JOINT MEETING of the corrosion group and the Manchester section of the Society of Chemical Industry will be held in the Robinson Lecture Theatre at the University, Manchester, on March 28. The meeting will commence with the annual general meeting of the Manchester section at 6 p.m., followed at 6.30 p.m., by a paper on "Recent Research on the Corrosion of Boiler Tubes" presented by Mr. E. C. Potter, PH.D.

WILLIAM JESSOP & SONS, LIMITED, Sheffield, are to instal in their Brightside works a consumable electrode arc-melting furnace, which it is claimed will be the largest of its kind in Europe. Its use will treble the firm's output of vacuum-melted steels and titanium alloys. The furnace, imported from Western Germany, will produce titanium ingots up to 1½ tons in weight, or vacuum-melted steel up to almost three tons in weight.

AMAZEMENT AT SHEFFIELD'S ACHIEVEMENTS in steel, education and other spheres, was expressed by Mr. S. Garthwaite, president of Yorkshire Federation of Master Plumbers' Associations, at their annual dinner/dance in Sheffield on March 6. He was proposing the toast of "The City and Trades of Sheffield," and the Lord Mayor, Alderman A. Ballard, responding, said Sheffield's fame was founded on the craftsmanship of its industries and professions.

THE MECHANICAL ENGINEERING RESEARCH LABORATORY, East Kilbride, Glasgow is to hold "open days" on Wednesday, June 4 and Thursday, June 5. The whole of the establishment will be open for inspection, including two new laboratories for research on mechanisms and engineering metrology, and for research on heat transfer. Applications to attend should state which day is preferred, and should be addressed to the director at the address quoted.

SO FAR THE 1957/58 PROGRAMME of the National Society of Master Patternmakers has included two works visits. The first, in November, was to Courtaulds, Limited, and the second, in February, to Richard Haworth, Limited. Both visits were arranged in accordance with the policy of the Society which is to visit firms, other than those concerned with pattern-making or founding, so that a wider knowledge of industry in general may be gained.

ENTRIES ARE INVITED by Casualties Union for the Buxton Trophy, the annual open competition in diagnosis and first-aid, which will be decided at the depot of the George Cohen 600 Group, Limited, Wood Lane, London, W.12, on October 5. Regional eliminating rounds will be held on July 6, or as determined locally. Entry forms may be obtained from the Competition Secretary, Casualties Union, 9, Wimborne Way, Elmers End, Beckenham (Kent).

ENGLISH STEEL CORPORATION, LIMITED, Sheffield, have acquired the Park Iron Works, Sheffield which are over a century old and are being vacated by Davy & United Engineering Company, Limited, who are concentrating their work at Darnall, Sheffield. The English Steel Corporation has already taken over the Davy & United foundry, but the smiths' department is being held by Davy & United until new accommodation is ready at Darnall. Davy & United office staffs moved to Darnall over the week-end of March 8.

A NEW £130,000 research and development centre for the chemical engineering industry is to be built at

News in Brief

Leven (Fife). A pilot plant and production shops will also be built on the 25-acre site. This was announced by Mr. W. E. Bryden, a director of Henry Balfour & Company, Limited, chemical engineers, last week. At present the annual turnover of the group is about £3,250,000. A contract with Russia for five spray driers for blood plasma has just been fulfilled. Before the war the group sent entire pulp mills to Russia.

THE NORTHERN IRELAND DEVELOPMENT COUNCIL announce that the Ministry of Commerce has agreed to build a standard factory of approximately 25,000 sq. ft. for Tolimit Gauges, Limited, on the Government factory estate at Dunmurry, near Belfast. Upon completion Tolimit Gauges will transfer to Dunmurry their entire production of precision gauges and automation equipment from their present factory at Fulham, London. Their initial labour force of 75 will include over 50 men; within two years it is expected to rise to about 140, including 100 men.

ENFIELD CABLES, LIMITED, announce the signing of an agreement with Federal Wire and Cable Division, H. K. Porter Company (Canada), Limited, whereby that organization will market Enfield products in Canada. The agreement also provides for the sharing of technical "know-how" and experience should Federal Wire & Cables decide to embark on the manufacture of power cables in the future. Enfield's resident engineer in Canada, Mr. J. Morgan-Blades, will remain in his present position and will act as technical adviser to Federal on power-cable matters.

NEWTON CHAMBERS & COMPANY, LIMITED, Thorncliffe, have entered into an arrangement with Bronswerk N.V., of Holland, to make and instal the boiler, Emma, in the United Kingdom. It is primarily intended for central-heating purposes and can burn a wide range of coke, including the large sizes difficult to market. It is claimed that the boiler can give a thermal efficiency in the 85-90 per cent. range, achieving a saving of 20 to 25 per cent. in fuel costs. The design is unique in that a secondary combustion chamber is incorporated thus making a gas producer as well as boiler.

GREAT BRITAIN is to receive a Promotion delegation from Queensland, which will arrive in this country on April 8 and stay for about four weeks. The main industrial centres are included in the tour. The delegation is headed by the Queensland Deputy Prime Minister, the Hon. K. J. Morris, M.L.A. The delegation is anxious to make contact with as many industrial and other interests as possible. Firms who would like to know more about business opportunities in Queensland should write to the Agent General for Queensland, 409, Strand, London, W.C.2, with a request that they should meet the visitors.

UNITED STEEL COMPANIES, LIMITED, Sheffield, are setting up a central drawing office in London at 125-127, Victoria Street, where it is expected that 20 to 30 men will be employed. Already about 150 draughtsmen are employed in the various works of the company. Mr. R. M. W. Lowe, until recently in the engineering department at Appleby-Frodingham Steel Company, Scunthorpe, has been appointed manager of the new office. He will be responsible to Lieutenant-Commander G. W. Wells, managing director, (engineering) of United Steel, and director and general manager of Appleby-Frodingham.

LESS THAN TWELVE MONTHS after receiving Treasury approval to the agreement under which Wild-Barfield Electric Furnaces, Limited, of Watford are manufacturing vacuum arc, induction and resistance furnaces and vacuum analysers to the design of National Research Corporation, Massachusetts, USA, the vacuum division reports very satisfactory progress. Orders in hand include a considerable number of vacuum furnaces, including the largest induction-heated equipment in the country and other units for melting and casting beryllium and uranium. In addition numerous orders have been received for vacuum gas analysis equipment.

THE SHORT DOCUMENTARY FILM "Fire Control in Industry" (made by Colt Ventilation, Limited, last year to show how the provision of fusible-link fire vents in an industrial building help the fireman in the event of fire and yet can also be used every day for ordinary ventilation needs) is now to be shown in the British Government Pavilion at the Brussels Exhibition by courtesy of the F.B.I. It is interesting to note that the British Government Hall of Technology at Brussels is ventilated by Colt—a third major exhibition building to their credit (they were responsible also for some of the ventilation at the Festival of Britain in 1951 and, last year, ventilated Olympia, London).

A NOTE in the South African journal *Engineer and Foundryman* informs readers that E. L. Midgley S.A. (Pty.) Limited, 18, Meson Road, Electron Township, Johannesburg, have recently imported equipment and materials for use with the Investril casting process. This process has been developed by W. J. Hooker, Limited, of London, and is based on the principle of lost wax casting. The basic equipment comprises a wax-injection machine vacuum investing unit and centrifugal casting machine. Moulds for the wax patterns are made of rubber for which a vulcanizing press is used. High-temperature investment refractories permit castings to be produced in alloy steels and similar materials.

THE RESEARCH STAFF of the International Nickel Company of Canada, Limited, have developed a new process for the electro-refining of nickel, the main feature of which is the direct electrolysis of nickel matte, and artificial sulphide. This contrasts with the usual electro-refining methods, including those employed in the nickel industry, in which a metal anode is used. The new Inco process eliminates high-temperature oxidation and reduction operations, with attendant losses of metals and sulphur and selenium. Instead, nickel sulphide of low-copper content from the Bessemer converter or other source can be cast directly into sulphide anodes and electrolyzed for the production of high quality nickel. Another feature of the process is that it permits the commercial recovery of elemental sulphur and selenium as valuable by-products, in addition to cobalt and precious metals conventionally recovered.

SHAW PROCESSES, LIMITED, of London and Newcastle, have installed an attractively designed display, at the Birmingham Exchange and Engineering Centre, including a wide variety of items produced by the Shaw process of precision casting. By this method almost any metal may be cast into a wide variety of shapes, with an accuracy equivalent to that normally attainable only by the "lost wax" process, or die-casting. Several well-known firms in Great Britain and abroad are licensees to this process, and all agree to a free exchange of technical information, culminating in improved methods and production. Associated with this organization are Clino Foundry Supplies, Limited, Zirconal, Limited, and Close Tolerance Castings, Limited, and a feature exhibit on the stand is a model of the Clino indirect-arc furnace. Also shown are many of the intricate items which are standard production with licensee firms.

Personal

The Earl of MORLEY has resigned from the boards of English Clays Lovering Pochin & Company, Limited, refractory manufacturers, etc., of St. Austell (Cornwall), and English China Clays, Limited.

Mr. G. C. HAYNES, director and secretary of Boulton Paul Aircraft, Limited, has been appointed deputy managing director, and Mr. G. A. WOOLSEY, previously chief accountant, has been appointed secretary.

Mr. ARTHUR STOREY has resigned as managing director and from the board of William Doxford & Sons (Engineers), Limited. Until other arrangements have been made Dr. J. RAMSAY GEBBIE has agreed to act as managing director of the company.

Seventy-eight-year-old Mr. HARRY VARNEY, stove grate fitter, Park Foundry (Belper), Limited, has retired after 64 years with the firm. He commenced at the age of 10, working when he was not at school, and became apprenticed to the foundry at the age of 14.

Mr. PETER K. HOGLUND has been appointed managing director of Euclid (Great Britain), Limited. He succeeds Mr. GEORGE M. PERRY, who, while continuing to serve on the board, will return to the US to become director of sales for the Euclid division of the General Motors Corporation.

It was announced on March 12 that the Earl of DUDLEY has retired from the board of the Westminster Bank, Limited. Lord Dudley, who now has to spend the winter months abroad on medical advice, retired from the boards of the Steel Company of Wales, Limited, and W. & T. Avery, Limited, in January.

Mr. T. W. BRIDGLAND, formerly with the Steel, Peech & Tozer branch of the United Steel Companies, Limited, and Lord Mayor of Sheffield in 1951, is retiring. Mr. Bridgland, who was with the company for 45 years, joined the research department machine shop in 1912, and was a chargehand for 18 years. He was responsible for the founding of the first works canteen.

Chairman and managing director of the General Electric Company, Limited, London, W.C.2, and on the board of many other companies, Mr. LESLIE GAMAGE has resigned from the chairmanship of British Overseas Fairs, Limited, but will remain on the board. Sir NORMAN KIPPING, director-general of the Federation of British Industries, has been elected chairman of British Overseas Fairs, in succession to Mr. Gamage.

Foundry foreman for the past 13 years at Darlington Railway Plant and Foundry Company, Limited, Mr. JOHN BULLEYMENT has retired after 52 years with the firm. His length of service is exceeded only by Mr. R. BLAYLOCK, the company's senior director. On his retirement, Mr. Bulleyment was presented with a fireside chair by the foundry staff. Mr. Winter, director and foundry manager, made the presentation.

Mr. A WYNN, chairman and joint managing director of Midland Electric Manufacturing Company, Limited, has intimated his intention of relinquishing executive duties in the near future. In this, the jubilee year of the company, he will complete 35 years of service, during which time he will have been a managing director for 18 years. Mr. Wynn is a member of the Council of the British Cast Iron Research Association and also serves on the Councils of the British Electrical and Allied Manufacturers' Association and the Birmingham Chamber of Commerce.

Dr. W. H. GARRETT, director of Monsanto Chemicals, Limited, has been elected president of the British Employers Confederation in succession to Sir COLIN ANDERSON. Dr. Garrett joined Monsanto in 1922, was appointed to the board in 1935, and became director of production the same year. He is vice-chairman of the Association of British Chemical Manufacturers and a life vice-president of the Association of Chemical and Allied Employers. He is also a member of the Grand Council of the Federation of British Industries; the Industrial Disputes Tribunal; the Chemical Engineering Committee of King's College, London; and of the appointments board of Liverpool University. Dr. Garrett is also a director of Metal Industries, Limited.

The foundry managers of two large Yugoslavian foundries arrived in Los Angeles on March 4 to begin a three-week tour of the United States to study American shell-mould and shell-core techniques. They are Ing. M. TOMOVIC, manager of the Petar Drapshin Foundry in Belgrade, Yugoslavia, who travelled as the guest of Shallway International Corporation, and Ing. B. MRAKOVIC, manager of the Yugoslavian government's Valjevo Foundry, who accompanied Mr. Tomovic on the tour. The Petar Drapshin foundry produces both ferrous and non-ferrous castings for automobile, textile, and agricultural equipment industries. The Valjevo foundry produces primarily bronze, brass, and aluminium castings, mostly in jobbing lots. The visitors planned to spend one week in Los Angeles, and several days each in Milwaukee, Cleveland, and Pittsburgh, returning *via* London. In Los Angeles, their visits include Quality Foundry Company, Bell Foundry Eld Metals, Pacific Mogulizing, Pacific Valve Company, Apex Pattern Works, Monarch Shell Casting Company, American Foundry Company and Universal Cast Iron Pipe Company.

Obituary

Mr. NORMAN WALTER TAYLOR, a former director of Charles Taylor (Birmingham), Limited, machine-tool manufacturers, died on March 8 at the age of 64.

Mr. JAMES D. LAING, commercial manager of the Barrhead, Glasgow, works of the Yorkshire Copper Works, Limited, Leeds, died on March 4 at the age of 53.

Mr. RONALD BARLING, secretary of the Dover Engineering Works, Limited (ironfounders), died suddenly on March 13, aged 38. His father was formerly secretary of the company and is now director of finance and administration.

Mr. HECTOR FOWLER, founder in 1919 of the business of Fowler & Holden (Grimsby), Limited, ironfounders and engineers, Church Street, Grimsby, died at the age of 71 on March 11. Mr. Fowler was an active member of the board of directors up to the time of his death.

Mr. HENRY HERBERT CLAYTON, home service manager of F. Perkins, Limited, diesel engine manufacturers, of Peterborough, died on March 2. He was 61. Mr. Clayton was with the Ford Motor Company, Limited, for 21 years before joining the Peterborough concern in 1945.

The death has occurred at the age of 73 of Mr. RUPERT JAMES ROGERS, managing director of the Parkinson Stove Company, Limited. Mr. Rogers—a vice-president of the British Cast Iron Research Association—was a past-president of the Council of the Society of British Gas Industries, the Institute of Vitreous Enamellers, and a member of the Council of the Institution of Gas Engineers. He was a founder member of the Birmingham Accident Prevention Council.

Imports and Exports of Iron and Steel in January

The following tables, based on Board of Trade returns, gives figures of imports and exports of iron and steel in January. Totals for January, 1957, are included for the purpose of comparison.

Total Exports of Iron and Steel

Destination.	Month ended January 31.		Month ended January 31.	
	1957.	1958.	1957.	1958.
	Tons.	Tons.	£	£
Channel Islands	378	371	26,594	23,623
Cyprus	707	562	52,675	40,897
Sierra Leone	1,114	1,615	71,671	103,430
Ghana	2,284	1,892	169,338	129,239
Nigeria	3,815	8,001	304,966	538,613
Union of South Africa	5,848	7,820	416,585	595,103
Rhodesia and Nyasaland	7,016	3,917	397,210	255,964
Tanganyika	3,000	865	164,829	62,156
Kenya	3,866	4,595	212,300	275,973
Uganda	686	211	35,481	12,960
Mauritius	368	235	24,249	19,898
Aden	208	669	17,090	33,159
Bahrein, Qatar, and Trucial States	131	741	10,462	59,646
Kuwait	443	2,251	50,525	164,133
India	20,880	12,227	1,247,160	823,543
Pakistan	2,003	14,006	122,965	802,284
Singapore	3,421	3,413	261,870	236,648
Malaya	3,281	1,120	190,958	82,756
Ceylon	2,787	2,473	172,212	155,748
British North Borneo	79	203	5,247	17,044
Hongkong	10,748	3,812	511,297	185,664
Australia	17,694	10,252	1,459,063	932,304
New Zealand	14,157	16,732	857,644	1,051,354
Canada	12,747	14,782	862,709	1,055,076
Jamaica	946	1,989	64,275	130,465
Trinidad	3,386	4,135	236,704	333,365
British Guiana	313	435	21,858	30,952
Other Commonwealth countries	1,984	3,197	110,973	202,864
Eire	3,887	3,922	222,820	237,026
Finland	6,579	4,610	434,161	352,832
Sweden	7,828	10,714	489,409	690,656
Norway	11,785	7,968	621,655	472,366
Denmark	6,995	5,971	431,978	439,660
Western Germany	3,238	415	105,482	45,193
Netherlands	8,826	5,383	582,153	352,906
Belgium	2,152	3,126	149,504	200,903
France	1,111	171	103,509	54,675
Switzerland	1,839	1,177	203,810	166,657
Portugal	1,501	1,414	122,949	106,266
Spain	1,763	3,378	149,605	262,586
Italy	9,245	3,474	347,720	174,786
Austria	335	640	40,567	81,630
Yugoslavia	743	657	36,331	38,280
Greece	511	1,292	39,974	94,536
Turkey	72	482	6,464	37,014
Netherlands Antilles	748	150	74,370	17,363
Portuguese East Africa	277	243	23,443	20,941
Egypt	—	2,960	—	117,265
Sudan	3,264	2,618	196,647	149,150
Lebanon	159	1,305	12,011	88,475
Israel	376	526	35,074	46,393
Saudi Arabia	91	122	12,094	13,186
Iraq	2,043	4,030	146,671	278,929
Iran	575	3,539	51,319	272,472
Burma	1,664	1,036	120,518	69,858
Thailand	618	778	40,874	58,081
Indonesia	237	463	23,739	44,750
Philippine Republic	122	52	4,214	6,689
USA	3,805	5,028	367,000	354,475
Cuba	354	658	23,236	49,046
Colombia	161	799	15,110	65,029
Venezuela	8,669	8,565	620,001	703,725
Ecuador	328	344	31,448	33,668
Peru	821	1,550	55,563	132,062
Uruguay	575	308	39,949	19,401
Argentina	5,454	15,314	407,917	1,162,281
Other foreign countries	17,488	11,727	931,134	883,066
TOTAL	240,529	239,430	15,399,333	16,749,138

FERRO ENAMELS, LIMITED, of Wombourn, Wolverhampton, have developed and placed on the market a vitreous-enamelled blackboard for schools. It shows a number of advantages over the traditional type.

Total Imports of Iron and Steel

From	Month ended January 31.		Month ended January 31.	
	1957.	1958.	1957.	1958.
	Tons.	Tons.	£	£
Rhodesia and Nyasaland	365	643	64,102	113,134
Canada	3,361	2,167	407,108	221,901
Other Commonwealth countries and Eire	2,141	1,922	149,256	125,962
Soviet Union	12,853	14,596	283,749	407,717
Sweden	3,349	2,739	404,071	356,957
Norway	9,703	6,706	785,252	517,761
Poland	1,066	—	66,173	—
Western Germany	10,798	6,506	701,944	519,591
Netherlands	5,376	15,480	247,801	834,600
Belgium	15,067	8,441	839,147	471,024
Luxembourg	3,888	876	216,358	42,936
France	9,487	5,037	783,121	460,837
Italy	232	41	18,634	29,152
Austria	13,851	542	411,558	55,667
Japan	2,604	383	201,687	39,490
USA	3,125	29,951	421,284	2,189,221
Other foreign countries	6,128	568	407,128	73,330
TOTAL	103,394	96,598	6,408,373	6,459,280
Iron and steel scrap and waste, fit only for the recovery of metal	59,133	23,643	1,547,010	461,376

Exports of Iron and Steel by Products

Product.	Month ended January 31.		Month ended January 31.	
	1957.	1958.	1957.	1958.
	Tons.	Tons.	£	£
Pig-iron	20,352	5,887	498,319	142,372
Ferro-columbium (niobium)	9	4	17,140	6,186
Ferro-tungsten	111	31	80,080	13,522
Other ferro-alloys	318	272	64,545	81,791
Ingots, blooms, billets, slabs, sheets, and tinplate bars	193	2,019	15,505	75,133
Iron bars, rods, angles, shapes, and sections	181	96	13,715	5,559
Steel bars, rods, angles, sections, and shapes	44,447	30,434	2,351,337	2,007,446
Iron plates and sheets	23	—	1,221	94
Universal plates	130	292	5,567	17,861
Steel plates, ¼ in. and under ⅜ in.	1,017	616	69,093	52,025
Ditto, ⅜ in. and over	13,402	13,687	701,081	824,366
Blacksheets and blackplate	28,098	31,989	1,909,320	2,186,609
Hoop and strip	8,441	2,121	354,583	436,879
Tinplate	27,112	24,115	2,151,546	1,941,467
Decorated tinplate	278	286	24,038	26,071
Galvanized sheets	15,263	5,320	1,108,552	412,421
Other (incl. tinned sheets, terneplate, and ternesheets)	1,933	1,353	194,308	125,375
Railway and tramway construction material	17,899	25,203	818,989	1,436,948
Wire rods of steel (incl. alloy steel)*	4,545	3,612	190,998	167,798
Wire	7,695	9,477	598,983	763,238
Tubes, pipes, and fittings	52,184	78,447	3,839,570	5,885,719
Iron castings	108	356	13,603	36,250
Steel castings	229	280	45,233	39,294
Forgings	561	451	63,970	64,714
TOTAL	240,529	239,430	15,399,333	16,749,138

* The figures for 1958 are not completely comparable with those for previous years.

Raw Material Markets

Iron and Steel

For many foundries producing light castings, as well as the textile and some of the jobbing foundries, there are no signs as yet of any upsurge in demands which would enable them to improve on the moderate outputs obtained for some time past. Many of the light foundries continue to have a lean time, and the currency restrictions in the domestic utensil trade and the reduced building programme continue to have an adverse effect on the trade, although seasonal influences should shortly bring some improvement.

The output figures of iron castings for 1957 indicate the extent of the improvement in demands from the motor vehicle trade during the whole of last year, and this increased business continues to be placed with the engineering and speciality foundries catering for that trade. From other trades fairly good demands are made for high-duty castings, although the machine-tool industry is not so busy and the heavy engineering trades also continue to show some reduction on previous demands.

From the furnaces in blast—approximately 97 in all—good outputs of pig-iron are obtained and these are generally more than adequate to satisfy current usage. Of the 97 furnaces, 59 are engaged in producing basic pig-iron for the steelworks. These supplies are sufficient for consumption and stock requirements, and although some tonnages continue to be received from abroad in completion of old contracts, the steelworks do not now have to rely on these.

Low-phosphorus irons are now being produced to satisfy current usage, and although some brands are still scarce, overall outputs are sufficient to meet demands. Producers are able to dispose of most of their makes and very little tonnage is going into stock. Hematite and refined irons are plentiful, and after the requirements of home users are satisfied, makers have tonnages to spare for shipment overseas as orders are obtained. Production of high-phosphorus pig-iron continues at a higher level than the call for this grade. Home orders continue moderate and the furnaces find it necessary to place tonnages in stock, which are available for export when orders can be obtained, but export merchants are up against strong overseas competition.

The foundries appear able to obtain all the scrap they need. Demands are chiefly for the better and heavier grades of cast-iron scrap. The medium and light grades are plentiful. Foundry coke deliveries are satisfactory, and ganister, limestone, and firebricks are readily available.

As stocks of steel semis are reduced, the re-rollers indent for supplies, but only when these are needed to implement the orders on hand. Forward buying is negligible and the scarcity of orders for small bars and light sections continues to curtail the demand for billets. Many of the small mills are engaged on a shortened working week, and the heavier mills could also increase their outputs if demands required. Home steelworks are able to satisfy promptly the present call for billets, etc., and could increase these supplies.

Non-ferrous Metals

A better tone in the US copper futures market, a belief that it will not be long before a balanced supply/demand position emerges, satisfactory trading activity on the London Metal Exchange and improved buying from US custom smelters, have combined to impart a firmer base to the copper market on both sides of the Atlantic and to push the London price higher.

On the big question as to whether America is headed for a slump or an upturn in its economy, opinion is still fairly divided. This position will, presumably, continue until the statistics for unemployment, production, inventories investment, etc., for March are released sometime in April. Meanwhile, the figures for February have been very disappointing. However, the full force of these indications have been offset by the further cutback in production announced by Kennecott last week, which in total amounts to about 7,000 tons a month. Moreover, the 10 per cent. reduction in output announced this week by International Nickel Company of Canada, Limited, will also affect copper, its chief by-product. The US price structure remains unchanged with the exception of scrap, which has edged up to 17.6 cents a pound.

Tin is steadier, both in London and in New York, than it has been for some time. The feature of this market is the growing evidence of the quota restrictions taking effect, and imports of tin concentrates into Malaya and Singapore in February fell to 791 tons, against 1,365 tons in January. Further, tin shipments from Singapore in the first half of March only amounted to 445 tons, compared with 812 tons and 1,402 tons in the first half of February and in the same period of March last year. The tin position in Indonesia is still confused, but the increasing trouble there can only redound to the disadvantage of the tin producers. Shipments are now falling off noticeably. The Indonesian situation is partly the cause of the erratic course of the Eastern price, although this is mainly due to quota restrictions which have upset the smooth flow of concentrates to the smelters. In the US light consumer buying is reported and the price is fairly steady around 95 cents. a pound.

Lead is once more steady, but featureless. The only real point of interest is the continued buying from the United States, which has resulted in a widening backwardation. It is thought that this will soon close up as it is now rumoured that the US Tariff Commission's recommendations will be available around the end of this month. In New York buying is of a routine nature and the price remains at 13 cents a pound.

Zinc is also steady, but dull. In the US figures now released show that stocks, though still climbing, are doing so at a slower rate than formerly. The US price is 10 cents a pound.

Jessop's offer Titanium

Making supplies of titanium available to industry on attractive terms, William Jessop & Sons, Limited, steelmakers, of Sheffield, offer to engineers and designers the opportunity to examine for themselves the properties of this comparatively new metal and its alloys in various projects. Although the basic element has been recognized for 160 years, it is only in the last 10 years that it has been possible to market titanium on a commercial scale.

William Jessop & Sons installed titanium production melting plant in 1956 and, to meet the ever-increasing demand for this material, a new consumable electrode arc-melting furnace, the largest in Europe, is to be installed. Manufacturing capacity will be trebled and the plant will enable ingots up to 24 in. in diameter and 3 tons in weight to be produced.

High-carbon Coke: Mr. G. W. Rousham of the Haven Foundry has made a correction to the comments on the use of high-carbon coke printed on page 247 of the JOURNAL of February 27 where the cupola lining diameter was quoted as 39 in. This is the shell diameter, the cupola being lined down to 27-in. inside diameter.

Current Prices of Iron, Steel, and Non-ferrous Metals

(*Delivered unless otherwise stated*)

March 19, 1958

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £21 6s. 0d.; Birmingham, £20 18s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £23 17s. 0d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £24 1s. 3d.

Scotch Iron.—No. 3 foundry, £25 3s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 19s. 0d.; South Zone, £26 1s. 6d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £27 6s. 6d.; South Zone, £27 9s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. of England (local iron), £25 6s. 6d.; Scotland (Scotch iron), Zone S:1, £25 13s. 0d.; Sheffield, £26 15s. 0d.; Birmingham, £27 4s. 0d.; Wales (Welsh iron), £25 6s. 6d.

Basic Pig-iron.—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leics.

FERRO-ALLOYS

(*Per ton unless otherwise stated, delivered*)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £47 10s. 0d. to £48 0s. 0d., scale 17s. 0d. per unit; 75 per cent Si, £67 0s 0d. to £67 10s. 0d., scale 17s. 0d. per unit.

Ferro-vanadium.—50/60 per cent., 26s. 6d. per lb. of V.

Ferro-molybdenum.—65/70 per cent., carbon-free, 12s. 6d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £299 0s. 0d.

Ferro-tungsten.—80/85 per cent., 8s. 8d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 11s. 8d. per lb. of W.

Ferro-chrome (6-ton lots and over).—4/6 per cent. C, £93 0s. 0d. to £96 10s. 0d., basis 60 per cent. Cr, scale 32s. 0d. per unit; over 6 per cent. C, £91 0s. 0d., basis 60 per cent. Cr, scale 31s. 0d. to 32s. 0d. per unit; 2 per cent. C,* 2s. 1d. to 2⅛d. per lb. Cr; 1 per cent. C,* 2s. 1½d. per lb. Cr; 0.15 per cent. C,* 2s. 2½d. per lb. Cr; 0.10 per cent. C,* 2s. 2¾d. per lb. Cr; 0.06 per cent. C,* 2s. 3d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 7s. 3d. to 7s. 10½d. per lb.

Metallic Manganese.—90/92 per cent., carbon-free, £282 0s. 0d.; 96/98 per cent., £315 0s. 0d.

Ferro-columbium.—65/75 per cent., Nb + Ta, 20s. 9d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £87 19s. 3d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £33 1s. 6d.; tested, 0.08 to 0.33 per cent. C, £34 1s. 6d.; hard (0.41 to 0.60 per cent. C), £35 3s. 0d.; silico-manganese, £44 2s. 6d.; free-cutting, £37 5s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £41 7s. 0d.; silico-manganese, £44 10s. 0d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.33 per cent. C, £38 16s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £39 18s. 6d.; acid, up to 0.25 per cent. C, £43 10s. 0d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £42 12s. 0d.; boiler plates (N.-E. Coast), £45 2s. 0d.; floor plates (N.-E. Coast), £44 1s. 0d.; angles (N.-E. Coast), £40 6s. 6d.; joists (N.-E. Coast), £40 2s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., and flats, 5 in. wide and under, untested soft basic, 50 tons and over, £40 8s. 0d. (under 10 tons to 4 tons, £41 5s. 6d.; under 4 tons to 2 tons, £41 10s. 6d.); hoop and strip, coils, £40 10s. 0d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., £45 16s. 0d.; black sheets (hand mill), 24g., £59 4s. 6d.; galvanized corrugated sheets, 24g., £67 6s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £69 9s. 6d.; nickel-chrome, £100 12s. 6d.; nickel-chrome-molybdenum, £112 16s. 6d.

NON-FERROUS METALS

Copper.—Cash, £168 5s. 0d. to £168 10s. 0d.; three months, £169 0s. 0d. to £169 5s. 0d.; settlement, £168 10s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 1s. 7½d. per lb.; rods, 192s. 9d. per cwt. basis; 20 s.w.g., 226s. 0d. per cwt.

Tin.—Cash, £730 0s. 0d. to £730 10s. 0d.; three months, £733 0s. 0d. to £734 0s. 0d.; settlement, £730 10s. 0d.

Lead (Refined Pig).—Second half March, £74 15s. 0d. to £74 17s. 6d.; second half June, £74 12s. 6d. to £74 15s. 0d.

Zinc.—Second half March, £63 7s. 6d. to £63 10s. 0d.; second half June, £63 10s. 0d. to £63 12s. 6d.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £98 0s. 0d.; rolled zinc (boiler plates), all English destinations, £95 15s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £85 10s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 1s. 4½d. per lb.; sheets to 10 w.g., 146s. 0d. per cwt.; wire, 2s. 2¾d.; rolled metal, 146s. 0d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £125; B6 (85/15), — ; BS249, —.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £162; HTB2 (38 tons), £180; HTB3 (48 tons), — .

Gunmetal.—BS1400, LG2 (85/5/5/5), £150; LG3 (86/7/5/2), £159; G1 (88/10/2/½), £216; (88/10/2/1), — .

Phosphor Bronze.—BS1400, PB1 (AID released), £235 per ton.

Phosphor Bronze Strip, etc.—Strip, 219s. 9d. per cwt.; wire, 3s. 5d. per lb.; rods, 2s. 8¾d.; tubes, 2s. 8¾d.; chill cast bars: solids 2s. 10½d.; cored 2s. 11½d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 4½d. per lb.; round wire, 10g. in coils (10 per cent.), 3s. 9d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 3s. 8d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 5½d. per lb. Antimony, English, 99 per cent., £190 0s. 0d. Quicksilver, ex-warehouse, £77 0s. 0d. Nickel, £600 0s. 0d. Aluminium ingots, £197 0s. 0d.; aluminium bronze (BS1400), AB1, £198; AB2, £216.

* Average 68-70 per cent.